WORKING PLAN

FOR THE

JAVADI AND YELAGIRI HILLS

[B.P. LAND REVENUE (FOREST) No. 172, DATED 13TH DECEMBER 1915.]

PREPARED BY

C. C. WILSON, Esq.,

Working Plans Officer, Southern Circle.

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Board of Revenue
(Land Revenue),
MADRAS.

Printed,

Proceedings, Forest No. 172, 13th December 1915.

Working-plan.

Sanctioning the — for the sandalwood forests of the Javadi and Yelagiri hills in the South Vellore division.

PROCEEDINGS OF THE BOARD OF REVENUE

(LAND REVENUE).

The Hon'ble Mr. H. F. W. GILLMAN, I.C.S.,
Commissioner of Land Revenue and Forests.

READ—the following papers :—

I

Letter—from P. M. LUSHINGTON, Esq., Conservator of Forests, Southern Circle.
To—the Secretary to the Commissioners of Land Revenue and Forests.
Dated—the 15th May 1915.
No.—564.

I have the honour to forward a Working Plan of the Javadi sandalwood area prepared by Mr. C. C. Wilson and to request that it may be sanctioned at a very early date. A copy of the Plan was sent to the Collector for favour of remarks as long ago as 6th April 1915 but no reply has been received and as the Collector has already approved of the Reconnaissance Report there is no necessity to delay the matter longer. In the meanwhile, however, I have received unofficially from the District Forest Officer, South Vellore (Mr. D. T. Barry), certain criticisms of the Plan which I have carefully considered.

2. Mr. Wilson has carried out his work excellently and his Plan is a real step towards the proper treatment of our sandal areas. For the first time a complete inventory has been made of the sandal stock over a large area. The total area covered with sandal is 82,189 acres of Reserved Forest and 30,414 acres of Unreserves. The actual distribution of the stock on this area is shown—

(1) by a carefully detailed Stock Map.

(2) by the statement of trees found in each Working Circle (paragraph 25) and the more detailed statement given in Appendix VI.

Not only is the great value of the forest indicated by these statements but an examination of them seems to show that the Javadi Hills are far richer in big trees than any other Sandal area in the Presidency.

3. Mr. Wilson has made a series of tree analyses and from them has determined that, in the Javadis, the rate of volume growth does not fall off even when the trees have reached an age of 70 years and a girth of 45 inches. Hitherto the exploitable age has been regarded as being somewhere between 50 and 70 years and trees of 36 inches girth were considered to be exploitable. It must however be remembered that when the Working Plans were framed it was often advisable to fell the larger trees, not because it was sylviculturally desirable, but because such trees were liable to be stolen. Mr. Wilson points out that in spite of this prescription of the former Working Plan, there are on the ground no less than 4,954 trees over 36 inches in girth of which 540 have reached a girth of 45 inches or more. (Introduction.)

4. In dealing with the Working Plan in detail I deem it necessary to make the following observations :—

Paragraph 1.—The sub-division of Ranges has already been carried out.

Paragraph 6.—The question of further reservation will be disposed of in August 1915.

Paragraph 8.—Mr. Wilson points out that there are 1,767 trees which are the property of the pattadars. I consider that we should purchase these trees from the pattadars paying them at a fixed rate according to the girth. The rate paid will be considerably in excess of what is offered by contractors but Government

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The proper housing of officers and subordinates is a matter of great importance. The District Forest Officer considers that nothing but the most vital work should be done during the hot weather months and the subordinates moved from the plateau. Experience has however shown that, if the men are properly housed and take proper precautions against Malaria, these unhealthy tracts often become comparatively healthy. As instances I quote Nedungayam in South Malabar and Chelama in South Kurnool.

The eradication of lantana is very essential. The Working Plans Officer points out that it has taken no real hold on the plateau and what there is can be removed at the present time at small cost.

I would also call attention to the remarks made in paragraph 11(*f*) concerning the *Zizyphus œnoplia*. I consider that its removal when it shows signs of "spike" is necessary and the necessity for its removal ought to have been embodied as a prescription in this paragraph.

Paragraph 41.—Extra establishment is proposed by the Working Plans Officer amounting to Rs. 9,384. Our Revenue is dependent on regular working of the forests and I regard this as an essential part of the Plan. Its cost has been taken into consideration in the Financial Estimate given in paragraph 42. It is only right that a forest which at the present time should yield a net annual Revenue of a lakh of Rupees and which is estimated to yield 4 lakhs twenty-five years hence should be properly manned.

Paragraph 42.—The District Forest Officer objects to the valuation made because the Working Plans Officer has adopted the rates for wood obtained in Mysore rather than those obtained in Vellore. The objection is valid and for the first few years of working it is quite possible that we may not work up to this estimate, more especially as the war is interfering with the Market. I do not however consider that the Estimate should be altered because we are aiming at classifying our wood after Mysore principles and eventually obtaining Mysore rates.

In column 5 of this Estimate the calculation has been incorrectly made by the Working Plans Officer as he has given the *monthly* instead of the *annual* Estimate of cost of the Establishment.

5. I have thought it necessary to review the provisions of this most important Plan at some length and I would now ask that it may be sanctioned with the modifications which I have suggested concerning girdling and "Ponakad" cultivation.

I have not dealt with the question of concessions to the Malayalis as this point is to be settled during the conference proposed to be held in August.

6. Finally, I request that Mr. Wilson's claim to a Working Plan allowance for the preparation of this elaborate Plan may be considered. The Plan itself, the Appendices, Maps and Graphs all show that Mr. Wilson has spared neither time nor thought on its preparation. The fact that all the work entailed has been carried out in a country where roads can scarcely be said to exist, where all kit has to be carried by coolies, and where fever is prevalent, shows that Mr. Wilson must have suffered from much exposure and expense. I can conceive of no circumstances under which any officer of the department has more thoroughly justified his claim to adequate remuneration.

THE JAVADI SANDALWOOD WORKING PLAN FOR THE SOUTH VELLORE FOREST DIVISION.

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THE JAVADI SANDALWOOD WORKING PLAN FOR THE SOUTH VELLORE FOREST DIVISION.

INTRODUCTION.

In the preparation of a Working Plan for sandalwood the fact that this species grows in patches irregularly scattered through the forest necessitates the making of a 100 per cent. enumeration or none at all. "Linear Surveys" or "Enumerations of Sample Plots" will not answer the purpose.

Owing to this necessity and to the difficulty of obtaining labour the complete enumeration of the 308 square miles of which the Javadi and Yelagiri plateaux are composed has taken a long time, and the preparation of this Plan will therefore have cost a considerable sum. But the great value of the knowledge of the stock present on the ground gained by this means fully warrants the expenditure incurred.

In spite of the fact that, for some years past, the felling of all trees of 36 inches in girth and over has been prescribed, there are now found to be present in the forest, no fewer than 4,954 such trees, and of these 540 are over 45 inches in girth.

The explanation of the presence of this large number of trees, which, under the Working Plans in force, should have been extracted in past years, is that no accurate knowledge of the enormous quantity of sandalwood present had been gained, and the areas prescribed for yearly felling were larger than could possibly be successfully worked without proper establishment. The rather high expenditure incurred in making the enumeration may then be considered to be fully justified by the fact that it has established the great value of the Forest which without it was not fully realised.

A statement of expenditure is appended—

	RS.	A.	P.
Pay of Working Plans Officer for two months and three days at Rs. 540 and for nine months at Rs. 580 (12 months in all) ...	6,399	15	3
Travelling allowance for do. do. ...	1,665	10	0
Pay of one Ranger at Rs. 60 for two months and at Rs. 80 for nine months, and for 2 Deputy Rangers at Rs. 30 for eight months and for 3 Deputy Rangers for six months including one Ranger for one month at Rs. 50 including famine batta ...	1,551	0	6
Travelling allowance for do. do. ..	789	4	6
Pay of office establishment of one clerk at Rs. 40, one draftsman at Rs. 40, and four peons at Rs. 8 and one peon at Rs. 7 including famine batta	1,245	0	4
Travelling allowance for do. do. ...	526	13	0
Payment of wages to coolies employed on enumeration of sandalwood trees	3,423	8	2
Office expenses, tour charges and other contingent expenses.	844	15	2
Total ...	16,446	2	11

In conclusion I must put on record the fact that the Special Working Plans Ranger, Mr. M. Muttuswami Ayyar, has been of great assistance in the preparation of this plan, has shown considerable ability and has worked with the utmost energy and keenness both in supervision of enumerations, and in the collection of data for the preparation of tree analyses and other statistics.

PART I.—SUMMARY OF FACTS ON WHICH THE PROPOSALS ARE BASED.

CHAPTER I.

DESCRIPTION OF THE TRACT DEALT WITH.

1. *Name and situation.*—This Working Plan prescribes for the treatment of the sandalwood in the forests of the Javadi and Yelagiri Hills and will be called the "*Javadis Sandalwood Working Plan.*"

These Javadi and Yelagiri Hills lie in the South Vellore Forest Division of the North Arcot District, and are situated south of Vellore Town. The Javadis

monopolize by far the larger area, the Yelagiris being a small isolated range lying just to the west of the centre of the former, and separated from it by a deep fertile valley.

These hills lie in between the two South Indian Railway lines running approximately north and south—the one from Katpadi to Villupuram, and the other from Katpadi to Erode. Both are easily accessible from the foot of the hills, and therefore enhance the value of the forests situated on them. The sandalwood is found scattered in patches throughout the forests, in three different forest ranges, namely, Chengam, Polur and Tirupattūr.

Further subdivision of these Ranges is now under consideration, and the present Plan will deal with the area as though subdivided into its four new parts, namely, Tiruppattūr, Polur, Santhavasal and Chengam. The general produce of the forests supplies the surrounding agricultural population and the large towns of the neighbourhood with poor timber and good bamboos and fuel. The sandalwood is however almost entirely sold for export, and is purchased by merchants from Bombay, Calicut and other large towns.

2. *Configuration of the ground.*—The Javadis of this district consist of a range of hills running north and south, attaining to a maximum length of 40 miles (approximate) and a maximum width of 16 miles (approximate). The outer slopes are steep and, for the most part, rocky. The centre and south of the range consist of several great undulating plateaux with occasional big valleys and hills cutting across them, and rising out of them; while, in the north, the ground is broken up into a series of hills and valleys with occasional small plateaux interspersed amongst them. The average height above sea level will be somewhere about 3,000 feet, a very favourable elevation for the growth of sandalwood. The highest peak however, Chembarai in Tiruppattūr Range, rises to a height of 3,855 feet.

The Yelagiris consist of a small range of hills with even steeper and rockier outer slopes than the Javadis. The summit is composed of one practically continuous plateau rather lower in the middle than at the sides and with "Sami Malai," a hill rising to 4,378 feet situated at its northern end. The average elevation of this plateau will be rather more than 3,500 feet which is considerably higher than any of the Javadi plateaux.

3. *Underlying rock and soil.*—The soil of the Javadis and Yelagiris is for the most part a fertile red clayey loam of sufficient depth to support the growth of large timber trees. It is however in places hard and stony and of a whitish colour and in such places no growth flourishes. The underlying rock, the disintegration of which gives rise to this soil, is a granitic gneiss, with occasional intrusive traps. The constituent minerals of which the gneiss is composed are not constant but vary considerably. Where the quartz constituent is more abundant the soil assumes the less fertile, hard and stony character referred to above.

4. *Climate.*—The climate is particularly favourable to the growth of sandalwood combining as it does comparative coolness with plenty of sunshine and a very fair rainfall, the latter however never being sufficient to cause a sodden condition of the soil, a state which is inimical to the growth of this species. The North-East monsoon is the heaviest, but as a rule sufficient rain falls during the South-West to ensure the germination and subsequent well-being of the sandal seed which has fallen.

The actual rainfall is not known as it is doubtful if the measurements recorded on the hills are accurate; but so far as these readings go, the general average for the past five years is 39·47 inches, as shown in the subjoined table:—

No.	Name of stations.	Total rainfall in inches in a calendar year.				
		1909.	1910.	1911.	1912.	1913.
1	Komnttiyore	47·80	38·80	23·20	45·46	37·6
2	Patrakad	44·20	34·88	31·00	51·54	45·3
3	Melpat	...	52·40	42·85	41·20	46·45
4	Kambugudi	...		40·38	...	32·74
5	Karnataghir	43·40	50·60	37 28	...	26·56
6	Shenbaga Tope	...	51·24	34·00	31·52	23·76

5. *Agricultural customs and wants of the people.*—The inhabitants of the Javadis and Yelagiris are a hybrid race known as Malayalis. They are descended from the original Vedars, immigrating Vellalas, and Goundars from the plains. Their pursuits are purely agricultural, and they do not require any sandalwood at all. Their wants need not, therefore, be considered in this Plan.

CHAPTER II.

COMPOSITION AND CONDITION OF THE FORESTS.

6. *Distribution and area.*—The forests consist of two blocks, the one situated on the Javadis and the other on the Yelagiris, the latter being of minor importance. Both of these blocks contain large unreserves.

These unreserves are of considerable importance in the Tiruppattūr Range of the Javadi Hills where they constitute about one-quarter of the whole of that plateau, and contain a great deal of extremely valuable sandalwood.

Proposals for further reservation in this Range are now being made, and I am preparing my Working Plan on the assumption that these proposals are accepted.

The total area of reserved forest and unreserved lands on the Javadis which contains sufficient sandal to warrant its inclusion in the Working Plan is 108,957 acres, or 170¼ square miles; and on the Yelagiris is 3,646 acres or 5⅔ square miles. The following statement gives more details :—

Name of reserved forest.	Total area.	Area included in Working Plan.
Tiruppattūr Range.		
	ACS.	ACS.
Andiappanur Reserved Forest	9,514	3,882
Inner Javadis „ „	31,665	6,949
Mambakkam „ „	10,608	8,231
Singarapet „ „	2,578	2,578
Singarapet extension Reserved Forest	6,939	1,560
Nagalathu ... „ „	2,810	1,506
Nagalathu extension „ „	1,225	123
Mangalam extension „ „	2,550	201
Jalarpet ... ... „ „	1,661	1,370
Chengam Range.		
Tenmalai Reserved Forest	28,030	7,112
Pelamarathur „ „	5,075	1,890
Nallappattu „ „	5,094	5,094
Polur Range.		
Veerappanur Reserved Forest	23,144	13,227
Patrakad „ „	23,793	10,327
Mulacad „ „	15,564	1,625
Santhavasal Range.		
Puttur Resered Forest	11,841	9,402
Arasampet „ „	4,414	2,575
Thellai „ „	5,164	3,234
Malayalam „ „	26,688	1,303
Total ...	...	82,189
Unreserves ...	..	30,414
Total ...	...	112,603

7. *State of boundaries.*—Demarcation is complete. The reserve boundary lines are 12 feet broad and are for the most part well kept and clean. They are marked by cairns of boulders intended to be so placed that one cairn is always visible from the next. The demarcation of the Reserves in the Chengam Javadis

was completed in 1906–07 at a total cost of Rs. 500 (approximate). Figures for the Tiruppattūr and Polur Ranges are not forthcoming.

8. *Legal position.*—The Reserves treated in this Plan have all been notified under section 16 of the Madras Forest Act and are the absolute property of the State. This will also be the case with the proposed reserves in Tiruppattūr Range, if the proposals for reservation are accepted. In addition to this, however, sandalwood is found scattered throughout the numerous small unreserves which are not of sufficient size and importance to place under reservation, and throughout the patta lands, on the Javadi and Yelagiri hills. All this sandalwood is the absolute property of Government with the exception of that situated in certain patta lands in the Tiruppattūr Range for which the pattas were granted prior to 1906, as, before this date, the insertion of a clause in the pattas reserving the sandalwood to Government was omitted. This is due to the fact that in and about that year the settlement of a lot of land held on sivoijama tenure was completed, the land being given to the holders without payment of any tree valuation ; and the presence of sandal trees was ignored. Of such trees there are 1,767 now in existence, scattered throughout the patta lands of this Range. Though this is not a large number it is sufficient to make it not difficult for unscrupulous contractors to extract from the hills sandalwood stolen from the reserves under the pretence that it has been bought from such private owners.

To prevent this, Government should buy from these pattadars *at the net market price which it obtains when selling its sandalwood for the year*, any trees that such pattadars may desire to dispose of. Should this policy be made widely known, there is no doubt that the Malayalis would sell to Government rather than to private contractors, as the latter pay at a very low rate. In this way Government would not *lose* anything over this wood, and would be gainers by just so many thousands of rupees as constitute the value of the timber that would otherwise be stolen from the reserves under cover of legitimate purchase.

Details of settlement are given in Appendix V.

In Komuttiyore Unreserve of Polur Range there are three blocks of forest known as blocks A, B and C. There seems to have been some doubt as to whether or not these blocks were legally reserved forest. In this connection it may be pointed out that originally the whole of the Komuttiyore Unreserve was reserved and that subsequently certain portions of it were disafforested in G.O. No. 1370, Revenue, dated 10th May 1913, the remainder being left as Reserve and constituting the three blocks referred to above. There is therefore no doubt that these three blocks are legally reserved forest, a matter of some importance as they contain good sandal growth.

Throughout the Javadis and Yelagiris grazing of goats in the Reserves is absolutely forbidden ; but this does not prevent a vast amount of damage being done by them.

Grazing concessions at a reduced rate are allowed to the Malayalis in Polur and Chengam Ranges, and in the Yelagiris of Tiruppattūr Range, on certain conditions. This is a very excellent plan as it is only by getting these villagers on to our side that we can hope to protect the reserves. But the concessions should be standardised,—at present they are different in each range,—and extended to the rest of Tiruppattūr Range—and the conditions must be strictly enforced, the concessions being withdrawn if they are not adhered to ; if this is not done the concessions tend to deteriorate into rights.

9. *Rights.*—There are no rights which affect the sandalwood in the reserves or unreserves.

10. *Composition and condition of the crop.*—Sandal grows in patches the area of which may vary from a fraction of an acre up to several hundred acres. These patches are scattered about throughout the forest, and it is often very difficult to assign any reason for the total absence of the species from one part of the forest which is similar in every respect to a neighbouring area where it is growing luxuriantly. It may well be that in former times the sandalwood was more or

less regularly distributed over the hills but was destroyed in certain parts by fires which did not sweep over the whole forest. Whatever the reason is the fact remains that the sandal occurs in patches of varying size and density, and it is due to this peculiarity in its occurrence that it has been necessary to make a 100 per cent. enumeration of the forest under treatment; all girth classes below 36 inches are on the whole fairly evenly distributed throughout the area; of the higher girth classes there is however a marked deficiency, owing to the prescription that has hitherto been in force under which all trees of 36 inches in girth and over were ordered to be felled. The sandal is without doubt spreading rapidly; natural regeneration is good, and trees are especially plentiful in abandoned cultivation, round enclosures and along paths and boundary lines, which is natural as sandal is a light demander. The fact that in areas which used to be under cultivation the soil has been worked and exposed to the action of the weather and to the visits of birds which eat the sandal seeds probably also accounts for such areas being well stocked.

It has been stated that on poor rocky soil the production of heartwood in the sandal is better than on good rich deep soil. This I do not consider to be the case. I believe the idea to have arisen from the fact that a dead or dying tree will often contain more heartwood than a healthy tree of the same age and size. This I have proved by measurements of actual trees growing side by side, of the same age and girth, the one being dead or dying and the other living.

Thus on stony unsuitable soil where the tree does not thrive it may become moribund and therefore contain more heartwood than a healthy tree of the same age growing on a rich deep loam; but the former stops growing, and its production of heartwood is limited at the utmost to the size of the dead tree; whereas the latter continues to grow, attains to a large size and produces eventually more heartwood year for year than the tree grown on bad soil Moreover it is probable that by girdling, and so killing, the trees while still standing some year or so previous to felling the same abnormal production of heartwood as is seen in trees that are dying naturally may be brought about artificially in previously healthy individuals.

The species is in general not very long lived; and appears to be about at its prime at 60 to 75 years of age, and 40 to 50 inches in girth at 4 feet from the ground, but this is probably due to some unfavourable condition such as the death of one or more of its hosts, damage by fire or some other injury. That sandal can attain to a much greater age and remain healthy is evidenced by the fact that there are trees growing in the Javadis under favourable conditions which are nearly 6 feet in girth at 4 feet from the ground and 90 to 100 years old, and which are perfectly healthy. An analysis of one such tree is given in Appendix IX.

Perhaps the most remarkable thing about this species is the fact that it is a root parasite of the most pronounced type. It is therefore quite impossible to grow it in pure forest. It is of importance to know on what species it will thrive best. It is found growing with a large number of associates and it is probable, though not yet by any means proved, that all these associates serve it as hosts. If this is the case it is important to ascertain which hosts produce the most vigorous growth and the greatest quantity and best quality of heartwood. A list of the associates and of the proved hosts may be found in Appendix III.

I have myself seen the root attachment with all the trees and shrubs named.

11. *Injuries to which the crop is liable*:—

(*a*) Fire.
(*b*) Grazing and browsing.
(*c*) Injury by man.
(*d*) Suppression by other growth (*e.g.*, creepers and climbers, lantana).
(*e*) Insects.
(*f*) Disease.

(*a*) *Fire.*—Sandalwood is peculiarly susceptible to injury by fire. A bad fire will kill off all the trees on the area burnt over, and a comparatively small fire will kill the seedlings and saplings. This is probably due to the fact that it is a very

shallow rooted species, and that the delicate haustoria by which its rootlets extract nourishment from other species, and which are seldom more than a few inches below the surface of the soil, are destroyed by the heat which might not be sufficient to do permanent damage to the rootlets themselves. With injury by fire is closely connected that by lantana—*vide* section (*d*) below.

(*b*) *Grazing and browsing.*—The damage done by grazing and browsing is also very great. Cattle eat the leaves of the sandal, though they are not leaf-eaters in general. Also their sharp hooves do great damage to the shallow roots of this species. But on the other hand they do a certain amount of good by preventing too dense a growth of grass which is bad for regeneration, and by working up the soil in walking over it. Limited grazing by cattle and sheep is therefore not a bad thing. But, on the other hand, goats will feed almost exclusively on the leaves of the sandal if allowed to do so and are an unmitigated pest. It is not putting it too strongly to say that any forest to which they are admitted in large numbers will in course of time cease for all practical purposes, to be a sandal producing area. They must be rigorously and uncompromisingly excluded from all the reserves and unreserves treated in this Working Plan.

(*c*) *Injury by man.*—The damage done by man takes many forms. To begin with he is largely responsible for that referred to under the above two sub-heads, fire and grazing. For forest fires are usually started by the Malayalis in order to improve the grazing, and facilitate collection of minor forest produce; and it is their herdsmen who lop the branches off and even fell large sandal trees to provide fodder for the cattle and goats. In an area of 301 acres in the Puliyur Unreserve west of Chittur village, a sample enumeration of sandal trees illicitly felled for this purpose was made and the following was the result :—

Diameter in inches.	Number of trees illicitly felled for goat browsing.
1	18
2	44
3	50
4	41
5	21
6	19
7	10
8	7
9	4
10	2
Total ...	216

Apart from these two methods of destruction the hillmen have an evil habit of barking the trees,—for purposes of chewing,—which is most harmful to the trees. Every path in the hills is lined by decrepit half-flayed sandal trees in a more or less dying condition. They also steal and sell the timber, of the value of which they are well aware. Direct theft of this sort is however becoming yearly more difficult as the forests are being opened up. The introduction of the sandalwood transit rules did a lot to stop this illicit traffic, and if in the future Government adopts the policy outlined in paragraph 8 above, of buying all sandalwood felled by private owners in the Javadis, it will close the one avenue by which it is still possible to bring off any extensive thefts.

(*d*) *Suppression by other growth.*—Many trees are suppressed and even killed outright by masses of creepers, more especially *Acacia Intsia*, *Pterolobium indicum*, and *Zizyphus Œnoplia*; all of these creepers probably act as hosts to the sandal, so they should not be destroyed, but they must be periodically cut back and care must be taken that they do not get up into the crowns of the trees. This matter is further dealt with in paragraph 37 below.

Growth of Lantana also constitutes a very real danger to sandal. This plant acts as a good host to the species but its habit of growth is such that where it exists it rapidly monopolizes the soil to the exclusion of most other species; then in the hot weather it dies and becomes very combustible and when it catches fire, as it is certain to do sooner or later, it will without doubt destroy every tree that may still

exist on the area. There is very little Lantana yet present in the Javadis; but it has been introduced in the unreserves and it must be immediately hunted out and destroyed wherever it is growing (*vide* paragraph 40 below).

(*e*) *Insects.*—There are several insects which are stated by Stebbing to bore into the heartwood of living sandal trees, namely a longicorn beetle (first said to be *Stromatium sp.* and afterwards a *Coclosterna sp.*), a wood wasp (*Sirex sp.*) and a moth (*Zeuzera coffeæ*). I have found in the Javadis only one borer, and that a longicorn beetle; but the imago bred out from larvæ by me was identified by the Forest Zoologist at Dehra Dun as one of the Lamiidæ and neither Stromatium nor Coclosterna. Sufficient is not yet known of the life history of any of these insects for it to be possible to prescribe preventive measures.

(*f*) *Disease.*—Of all the dangers to which sandal is exposed attack by "spike disease" is the most to be feared. Little is at present known of this disease except that it spreads rapidly and kills many thousands of trees.

There is at present no sign at all of this disease anywhere in the Javadis or Yelagiris; but a careful watch must be kept, for it is possible that it may appear, and any suspicious tree must be immediately uprooted and burnt. Photographs are attached showing the leaves of a spiked tree and of a healthy tree side by side (*vide* Appendix No. VIII).

All subordinates employed on sandal operations should be made familiar with the appearance of this disease so that they may be able to recognise it if they see it.

The creeper *Zizyphus Oenoplia* is found on the Javadis attacked by a disease which resembles in its outward manifestation "spike" in sandal; it is believed that there is not any connection between the two diseases, but to be on the safe side all *Zizyphus Oenoplia* found showing signs of "spike" should be destroyed. Many sandal trees become stagheaded and die from other causes than spike disease and it is not an uncommon thing for such cases to be reported as "spike" by the inexperienced. This unhealthy condition may be induced by fire, by a dry and stony soil, by lack of suitable hosts and by a variety of other causes; a photograph of such a tree may be seen in Appendix No. VIII. Care must be taken that such a condition is not confused with spike disease.

CHAPTER III.

SYSTEM OF MANAGEMENT.

12. *Past and present systems of management—Polur and Chengam Ranges.*—Polur and Chengam Ranges have hitherto been worked on a plan drawn up by Mr. V. S. Gurunatha Pillai and introduced in 1905. This plan prescribed for the working of all the produce of both Ranges. So far as it affected the present Polur Range it was revised by Mr. J. S. Battie and the revised plan received the sanction of the Board of Revenue in 1907. This plan included certain areas of the present North Vellore forest division, namely, the Thellai and Arasampet reserves. A redistribution of the two forest divisions is now under consideration with the object of bringing back under the District Forest Officer, South Vellore, such parts of these two reserves as contain sandalwood in workable quantities. The present Working Plan is being prepared on the assumption that these proposals are sanctioned. The revision by Mr. J. S. Battie affected the sandalwood working very little, and it has therefore been practically the same in both these Ranges since 1905.

Each of the following reserves, namely, Puttur, Veerappanoor and Patrakad in Polur Range and Nallappattu and Tenmalai in Chengam Range, was treated as a separate Working Circle under the selection system on a five-year felling cycle; this gave, in Polur Range, three coupes per year averaging about 5,000 acres each and in Chengam Range two coupes per year, averaging about 1,500 acres each. In the Puttur Working Circle were included the sandal-bearing areas of Arasampet

and Thellai reserves and in the Patrakad Working Circle the sandal-bearing areas of the Malayalam reserve.

Prior to 1905 no record of sandal working in these reserves is forthcoming beyond the fact that in the years 1900 to 1903 Rs. 800 was realised by the sale of sandalwood felled departmentally.

Tiruppattūr Range.—For the sandalwood in Tiruppattūr Range a Working Plan was drawn up by Mr. M. Rama Rāo which was sanctioned in 1904. This covered a period of seven years and prescribed selection fellings over the whole of the Tiruppattūr Javadis every year.

After the end of the prescribed "felling period," that is to say since the year 1911–12, pending the preparation of a more permanent Working Plan, extraction on the same lines has continued, but only from the unreserves.

Before 1904 working of sandal was of a desultory nature, on the selection system, by departmental agency. For two years extraction by contractors was tried but was found to be unsatisfactory.

In all three Ranges the extraction of only such trees as were dead or dying or were of a minimum girth of 36 inches at 4 feet from the ground was prescribed. The method of extraction and cleaning was in accordance with the rules laid down in the "Standing Order on Sandal Operations," drawn up by Mr. M. Rama Rao, and issued by Mr. Lodge in Salem district in 1901. Under these rules all trees were uprooted; were billetted, rough cleaned, marked, measured and weighed in the forest; and were exported to the sale depot before final cleaning.

The felling rules prescribed in Appendix II of the present Working Plan are modelled on this Standing Order.

13. *Special works of improvement undertaken.*—In Chengam and Polur Ranges the works of improvement prescribed are confined to the assistance of natural regeneration. The closure of small selected areas to grazing is recommended, and it is stated that where the sandal is in danger of suppression it must be freed by cutting back, not uprooting, the dominating growth. The maintenance and annual measurement of sample plots, and record of the observations made, is also prescribed. There is however no record of any such works of improvement having been undertaken.

In Tiruppattūr Range.—Annual sowing of seed under clumps of coppice shoots on specially cleared and prepared 10-acre blocks is prescribed, accompanied by closure to grazing and rigorous fire-protection. It is also suggested that legalised "Ponakadu" may be allowed on the condition that the land ponakaded be handed back to the Forest Department with a crop of young sandal on it after a given number of years. Assistance of natural regeneration and the *cutting back* of growth that is interfering with the sandal is also prescribed for especially promising areas.

In this Range works of improvement were not confined to the prescriptions of the Working Plan, but were actually undertaken. In the years 1906–07 and 1907–08 climber cutting was done by the forest subordinates and was therefore accomplished without having any expenditure shown against it. And in 1907–08 ten acres in Nagalathu Reserved forest in the Yelagiris was sown with sandal seed, of which 50 per cent. was reported to have germinated and to be doing well.

14. *Past Revenue and Expenditure.*—The Revenue and Expenditure for the twelve years prior to 1904 is given in the Tiruppattūr Working Plan drawn up by Mr. Rama Rao. An abstract of his figures is embodied in the following statement. For the Chengam and Polur Ranges no reliable figures for years prior to 1905 are forthcoming. The figures given for years subsequent to these are compiled from such records as are available in the Vellore and South Arcot District Forest offices. The expenditure includes all sums spent on felling, rough and final cleaning, and transport, but does not include the cost of any establishment as no special staff has hitherto been maintained for sandal operations.

STATEMENT of Revenue and Expenditure on sandalwood from 1893 to 1913.

Year of working.	Tiruppattūr Range.			Polur Range.			Chengam Range.			District total.		
	Revenue.	Expendi-ture.	Surplus.	Revenue.	Expendi-ture.	Surplus.	Revenue.	Expendi-ture.	Surplus.	Revenue.	Expendi-ture.	Surplus.
	RS.			RS.			RS.			RS.		
1893-94 ...	2,393	97	2,296							2,393	97	2,296
1894-95 / 1895-96	6,495	507	5,988							6,495	507	5,988
1896-97 / 1897-98	5,928	231	5,697							5,928	231	5,697
1898-99 ...	...	...	...	Not available.						...	...	...
1899-00 / 1900-01	1,938	56	1,882							1,938	56	1,882
1901-02 ...	...	...	...							...	...	...
1902-03 ...	12,902	635	12,267							12,902	635	12,267
1903-04 ...	9,212	468	8,744							9,212	468	8,744
1904-05 ...	8,728	419	8,309							8,728	419	8,309
1905-06 ...	3,251	307	2,944	26,812	1,347	25,465	15	...	15	30,078	1,654	28,424
1906-07 ...	9,051	414	8,637	23,553	1,356	22,197	192	...	192	32,796	1,770	31,026
1907-08 ...	6,652	384	6,268	32,354	1,925	30,429	6	...	6	39,012	2,309	36,703
1908-09 ...	6,177	341	5,836	32,863	2,059	30,804	6,241	697	5,544	45,281	3,097	42,184
1909-10 ...	7,609	549	7,060	26,166	1,709	24,457	37,679	3,044	34,635	71,454	5,302	66,152
1910-11 ...	9,943	575	9,368	37,144	3,144	34,000	25,974	2,514	23,460	73,061	6,233	66,828
1911-12 ...	4,906	140	4,766	27,150	2,575	24,575	44,372	2,652	41,720	76,428	5,367	71,061
1912-13 ...	23,531	720	22,811	44,225	2,526	41,699	55,167	2,701	52,466	1,22,923	5,947	1,16,976

CHAPTER IV.

UTILIZATION OF THE PRODUCE.

15. *Marketable products; quantities extracted in past years.*—The quantity of heartwood and chips extracted and sold in the past is given below in quarters of 28 lbs.

Year.	Tirupattūr Range.	Polur Range.	Chengam Range.	District total.
	QRS.	QRS.	QRS.	QRS.
1893-94	493			493
1894-95 / 1895-96	1,294			1,294
1896-97 / 1897-98	1,268			1,268
1898-99	...	Not known.		...
1899-00 / 1900-01	434			434
1901-02	Nil.			Nil.
1902-03	2,244			2,244
1903-04	1,696			1,696
1904-05	1,296			1,296
1905-06	1,046	3,974	2	5,022
1906-07	1,353	3,859	31	5,243
1907-08	1,054	5,083	1	6,138
1908-09	995	5,489	1,198	7,682
1909-10	1,200	3,852	4,846	9,898
1910-11	1,613	5,816	4,210	11,639
1911-12	736	3,406	5,284	9,426
1912-13	2,399	6,165	5,329	13,893

The figures for Tiruppattūr Range for the years 1893 to 1904 are taken from Mr. Rama Rao's preliminary Working Plan for that Range. The remaining figures come from the records in the Vellore and South Arcot District Forest Offices. Full details of these may be found in Appendix IV.

N.B.—This Working Plan will treat of tons, quarters and pounds only, and not of maunds as the latter is an inconstant weight. The custom in South Vellore appears hitherto to have been to work in quarters of 28 lbs. and to sell by maunds of 25 lbs. This custom tends to create confusion and should be discontinued.

16. *Lines of export.*—The rough cleaned wood is exported to Tiruppattūr from Tiruppattūr Range, to Tiruvannamalai from Chengam Range and to Polur and Vellore from Polur Range. It is carried by headloads to the foot of the hills or to the nearest cart road, and thence in carts to these sale depots. There are now in existence four ghat roads leading from the plateaux down to the plains; these run from Kambugudi to Andiappanoor, from Komuttiyore to Alangayam, from Mandaparai to Melarasanpattu and from Patrakad to Thaniar. There is also a bridle path from Melpat down to Paramanandal.

These roads are however not at present very largely used for carting sandalwood owing to the fact that there are no cart roads on the plateaux and therefore no carts. It is therefore of great importance to open up the plateaux with good roads and thus encourage cart traffic, as this will greatly cheapen the extraction of the sandalwood.

17. *Markets.*—The sandalwood when it reaches the sale depot is there finally cleaned of all sapwood, classified and sold in auction or by sealed tender. It is usually purchased by merchants from Bombay or Calicut; very little is consumed locally. Sales take place annually in Tiruppattūr, Tiruvannamalai and Vellore. All these places are on the railway line but none of them are easy of access for buyers. It would probably be better to have in the future two sale depots only, one at Katpadi and the other at Jolarpet. The dates of auction could then be arranged to fit in with those held in Mysore and in the other parts of the Madras Presidency so as to suit the convenience of buyers. This would almost certainly lead to greater competition and consequently to enhanced prices.

18. *Mode of extraction and its cost.*—In all three Ranges the mode of extraction is the same, as the felling rules issued by Mr. Lodge for Salem District in 1901 are in force throughout the district (*vide* paragraph 12 above). The trees are uprooted, billetted if necessary, and rough cleaned in situ, and are then carried by headloads to Forest depots. Here they are checked by laying out each tree by itself in the form in which it grew, and are then measured, weighed, numbered and hammer marked. On completion of this work the wood is carried by headloads to the foot of the hills or to the nearest cart road and thence carted to the various sale depots, where it is finally cleaned and classified ready for sale. The cost of carting varies according to the rates in force; details are given in Appendix IV.

The cost of the previous operations, that is to say extraction and transport to the cart road, varies in the three Ranges. The method and rate of payment in force in Chengam Range is the best, and with it the coolies are satisfied. In the other Ranges they are not satisfied. Their reasons for coming to do the work in spite of this are obscure, but may probably be assigned to either fear or corruption. This is not a desirable state of things and a uniform and adequate rate of pay should be introduced based on that in force in Chengam Range.

In Tiruppattūr and Polur Ranges "mamool" rates for felling, rough cleaning and transport to the plains have been in force since 1905–06. In Tiruppattūr this rate is Re. 1 for five quarters for the whole operation and in Polur Rs. 11 per ton for felling and rough cleaning plus Rs. 5 per ton for transport to the plains. In Chengam Range figures are forthcoming only from the year 1908–09. Here payment has been made separately (1) for felling, rough cleaning and transport to the Forest depot and (2) for transport to the plains.

The first operation was paid for at a rate of 2 annas per quarter in 1908–09, and 1909–10, and since then at a rate of 2½ annas per quarter. The cost of transport to the plains varied from 2 to 4 annas per quarter, according to the distance to be traversed. We thus get the following comparative statement of the cost of the whole operation in each range :—

	Cost. A.	P.	
(1) *In Tiruppattūr* since 1905	3	2	per quarter.
(2) *In Polur* since 1905	3	2½	"
(3) *In Chengam* from 1908–10	4	0	"
Since 1910	5	3	per quarter on an average.

Full details may be found in Appendix IV.

19. *Net value of each class of produce.*—The average price obtained per quarter of sandalwood for each of the past nine years is given below together with the average cost of production (for particulars *vide* Appendix IV). The average net value per quarter for each year is thus obtained.

Year.	Average price obtained per quarter.			Average cost of production per quarter.			Average net value per quarter.		
	RS.	A.	P.	RS.	A.	P.	RS.	A.	P.
1904–05	6	0	0	0	5	0	5	11	0
1905–06	5	15	9	0	4	6	5	11	3
1906–07	6	3	5	0	5	5	5	14	0
1907–08	6	5	8	0	5	9	5	15	11
1908–09	5	14	4	0	5	7	5	8	9
1909–10	7	4	0	0	7	2	6	12	10
1910–11	6	6	0	0	7	3	5	14	9
1911–12	8	1	0	0	7	1	7	9	11
1912–13	8	13	7	0	6	11	8	6	8

To take the average of these nine years as being the probable net price obtainable in the future would not give the true value of the produce, as the price has been rising rapidly for the past year or two, and will almost certainly continue to rise still higher owing to the fact that the largest of the present sandal producing areas, viz., Mysore and Coorg, are afflicted by spike disease and there will therefore in all probability be a shortage of supply in the near future.

A statement of the prices obtained in Mysore this year is given below and they show an average rate per quarter of Rs. 12–12–0. Taking this figure in conjunction with our highest expenditure for the whole district on production, viz., that for 1910–11 (which includes extraction, carting to sale depot and final cleaning) we get an average net value of Rs. 12-4-9 per quarter, and this is in all probability a fair estimate of the future value of the sandalwood.

Statement of prices paid in Mysore for 1913-14.

Class.	Quantity sold. Tons.	Cwt.	Average price per quarter in rupees.
1st class	...	...	...
2nd „	11	5	13
3rd „	5	6	13
4th „	3	2½	16
5th „	9	5	15
6th „	7	10	12
7th „	30	0	16
8th „	29	2	16
9th „	16	14	17
10th „	90	0	14
11th „	28	0	13
12th „	8	15	13
13th „	1	17	12
14th „	29	10	10
15th „	0	4½	7
16th „	55	10	7
17th „	14	0	7
18th „	0	10½	6

N.B.—Even though it is possible that during the present war the price of sandalwood will fall, it is highly probable that it will rise again to its present price and higher, after the war is over.

CHAPTER V.

MISCELLANEOUS FACTS.

20. *Forest staff.*—There is no special staff employed on sandalwood operations; the work is done by the general establishment, a Deputy Ranger or Forester being deputed every year in each range to attend to the fellings. Nobody is employed on works of improvement.

21. *Labour supply.*—The necessary supply of labour is obtained from the Malayalis settled on the hills. The supply is adequate but owing to the low rate of remuneration paid in Polur and Tirupattūr Ranges there is sometimes difficulty in obtaining men. This matter is dealt with more fully in paragraph 18 above.

22. *Water-supply.*—The whole of both the Javadi and the Yelagiri plateaux are well supplied with water throughout the greater part of the year from tanks and wells situated in the numerous hill villages. There are also departmental wells at Kambugudi in Tirupattūr Range, at Patrakad and Komuttiyore in Polur Range and at Melpattu in Chengam Range. But in the Javadis during the hot months, from March to July, the water dries up and there is great scarcity, the hills being very unhealthy so long as the drought continues.

This is not the case in the Yelagiris, where good water is obtainable as a general rule throughout the year.

23. *Rest-houses.*—The following is a list of forest bungalows in the Javadis and Yelagiris:—

Polur Range.

Patrakad ... ... Komuttiyore ... ... Mandaparai .. ... Nadanur	These are all old bungalows and are scarcely habitable being really beyond repair. A new bungalow is now being built at Patragad.

Tiruppattūr Range.

Kambugudi	A small but well built bungalow.
Kottur on the Yelagiris	A good bungalow.

Chengam Range.

Melpattu	An old bungalow but in fair condition.

There are Rangers' quarters at Patrakad in Polur Range; and subordinates' quarters at Komuttiyore in Polur Range, and at Kambugudi and Kottur in Tirupattūr Range.

PART II.—FUTURE MANAGEMENT.

CHAPTER I.

BASIS OF PROPOSALS.

24. *Summary of prescriptions:*—(1) *Formation of Working Circles.*—The area is to be divided into five Working Circles (paragraph 25).

(2) *Further sub-division.*—Each Working Circle will be further subdivided into Felling Series for convenience of working, and each Felling Series in the Javadis into six annual coupes, and in the Yelagiris into three annual coupes (paragraphs 26, 33 and 35).

(3) *Object of Working Plan.*—The object of working is to produce a forest that will yield the maximum quantity of sandal heartwood. For this purpose it is necessary to refrain from cutting immature trees, and to do all that is possible to encourage the spread and healthy growth of the species (paragraph 28).

(4) *Method of treatment.*—For the attainment of the conditions outlined above it is necessary at present to make improvement fellings, involving the extraction of dead and dying trees only (paragraph 29); and, with this, to undertake intensive tending and cultural operations (paragraphs 37 and 38).

(5) *Period and Cycle.*—The Felling Cycle is fixed at six years for the Javadis and three years for the Yelagiris, and the felling period at eighteen years. Thus in the Javadis the whole forest will be worked over three times in the period that this Working-Plan is to run, and in the Yelagiris six times (paragraph 32).

(6) *Annual coupes.*—For the areas to be felled annually—*vide* paragraphs 33 and 38.

(7) *Fellings.*—Dead trees are to be extracted by uprooting in the year of marking; and dying trees are to be girdled and left to die slowly for two years before being extracted (paragraph 34 and Appendix II).

(8) *Forecast of condition of crops.*—At the end of the felling period it is expected to have a nearly normal sandal forest, and to be in possession of sufficient data to make it possible to fix the rotation of sandal It is *expected* that trees of about 15 inches in diameter and over will be considered mature and will be liable to extraction (paragraph 36).

(9) *Tending the crop.*—In the year following felling all sandal trees in the coupe which show signs of suppression will be set free from the growth dominating them. And in addition to this certain blocks of especially promising forest varying from about 25 to 50 or 100 acres in area will be selected and set apart for special protection. In these blocks sample plots will be measured and marked yearly (paragraph 37).

(10) *Cultural operations.*—Natural regeneration will be depended upon for restocking the forest. This will be assisted by letting in light to, and working the soil round, promising seed bearers. The operations must be taken up immediately after felling is completed; and all young seedlings must be watched and protected for three years (paragraph 38).

(11) *Grazing.*—No foreign cattle are to be admitted to the hills at all. The cattle and sheep of resident Malayalis only may be grazed and this grazing should be free on concession, on condition that the villagers protect the sandalwood. Goats must be absolutely forbidden to browse anywhere in the reserves and this rule most strictly enforced (paragraph 39).

(12) *Construction* of roads and bridle paths at a cost of Rs. 62,300 and of bungalows and subordinates' quarters at a cost of Rs. 35,780 is prescribed; the expenditure to be spread over the next five or six years (paragraph 40).

(13) *Fire protection.*—Cutting of *new* firelines, except round small specially protected blocks, is not prescribed. A system of rewards and grazing concessions to villages situated in the sandal tracts is to be tried (paragraph 40).

(14) *Lantana.*—Lantana exists in the hills in the Chengam unreserves in very small quantities. It must be eradicated at once; the cost will be negligible (paragraph 40).

(15) *Changes in staff.*—An increase in the number of Deputy Rangers and Forest Guards is prescribed so as to give one Deputy Ranger and one Forest Guard to each felling series in the Javadis and one Deputy Ranger and two Forest Guards to the whole of the Yelagiris Working Circle. This staff to be employed solely on sandal operations (paragraph 41.)

(16) *Financial results.*—The probable financial results of the proposed working will be that, for the period of the Working-Plan the revenue will sink to Rs. 1,09,396 per annum net; that it will then rise to Rs. 2,0?,001 per annum net; and thereafter will rapidly increase till it reaches a maximum of not less than Rs. 4,03,291 per annum net profit (paragraph 42).

(17) *Control.*—The maintenance is prescribed of a special sandalwood register and of a sandalwood control map. These to be in addition to the usual forms 5 and 6 and the control journal. The register is to contain complete data for the preparation of another Working-Plan in eighteen years' time, giving girth, age and weight of heartwood of trees extracted each year (paragraph 43).

(18) Appendix I contains the following maps:—

(1) Coupe map (shows Working Circles, coupes and Felling Series).
(2) Road map (shows roads, bungalows and firelines).
(3) Stock map. (This serves the purpose of a "description of compartments").

(19) Appendix II consists of detailed rules for felling, dressing and classifying the sandalwood (page 51).

25. *Working Circles.*—The South Vellore Forest Division is now in process of slight enlargement, involving the addition of another Range. There will be then five ranges in the South Vellore Division of which four contain sandalwood. It is proposed to exploit each of these four areas separately, and each Range will therefore form a separate Working Circle. In addition to these the Yelagiris in Tirupattūr Range which forms a separate, compact block, containing very young

trees, will need different treatment and will therefore be exploited as a fifth Working Circle. Thus there will be the following five Working Circles:—

Number	Working Circle.	Area.	Number of trees.
1	*Tirupattur Sandalwood Working Circle*, comprising all the Sandalwood areas in Tirupattur range with the exception of those on the Yelagiris.	30,152	213,516
2	*The Yelagiris Sandalwood Working Circle*, comprising all the sandalwood areas on the Yelagiris.	3,646	94,675
3	*Chengam Sandalwood Working Circle*, comprising all the Sandalwood areas in Chengam Range.	23,358	98,315
4	*Polur Sandalwood Working Circle*, comprising all the Sandal areas in Polur Range.	30,960	205,399
5	*Santhavasal Sandalwood Working Circle*, comprising all the Sandal areas in Santhavasal Range.	24,487	183,243

(*Vide* Map No. 1, Appendix No. I.)

26. *Further sub-division.*—Each of these Working Circles will be further subdivided into Felling Series for convenience of working, one coupe in each Felling Series being exploited annually.

Tirupattūr Sandalwood Working Circle will consist of four Felling Series.
Yelagiris Sandalwood Working Circle will consist of two Felling Series.
Chengam Sandalwood Working Circle will consist of three Felling Series.
Polur Sandalwood Working Circle will consist of three Felling Series.
Santhavasal Sandalwood Working Circle will consist of three Felling Series.

27. *Analysis of crop.*—A complete enumeration in one inch diameter classes has been made of the sandal throughout the area treated; details are given in Appendix VI.

It is however the case that some trees were overlooked as is indeed unavoidable in an enumeration of this kind. From the checks made it was found that this number was about 10 per cent. of the total. It will therefore be quite safe in calculating the future yield to use the figures obtained as they probably represent only about 90 per cent. of the stock that is actually present on the ground. The trees are for the most part healthy and well grown and natural regeneration from seed is excellent. There is however a disproportionate preponderance of the lower age classes, which is accounted for by the fact that in previous Working Plans felling of all trees of 36 inches in girth and over was prescribed; this prescription was, however, for various reasons, not strictly adhered to and the consequence is that there are some big old trees still present though the proportion of such is of course not normal.

CHAPTER II.

METHOD OF TREATMENT.

28. *Object sought to be attained.*—The object of this Plan is to produce a sandalwood forest that will give a maximum sustained annual yield. For the achievement of this purpose the following facts must be considered.

The forests under treatment are remote and difficult of access, and it is therefore not likely that they will ever be of much importance as timber or fuel producers. They are however eminently suitable for growing sandal, which is as already pointed out spreading rapidly, and is almost as rapidly increasing in value.

The trees here are at present felled at a size that is rarely attained in other sandal producing districts, but even so they are being felled too young. The prescriptions of this Plan are therefore so devised as to ensure the trees being allowed to continue growing as long as they are doing so vigorously. This state depends not only on the sandal trees themselves but also very largely on the condition of their hosts, and this peculiarity makes it difficult to prescribe for this species any fixed rotation or maximum felling girth as is customary for other species.

From analyses which have been made of trees varying in size, curves showing height, diameter and volume increment have been prepared. For really healthy trees these tend to shew that the rate of volume growth does *not* fall off even when the trees are over seventy years old and over 45 inches in girth (*vide* Appendix IX). To fell such trees as these, would be sacrificing capital that is paying a good rate of interest, and they must therefore be left standing even though this entails a loss of immediate revenue.

No doubt the sandal, like other trees, does reach an age after which, however vigorous it and its hosts may be, its rate of volume increment declines; but the paucity of healthy, mature trees in these forests makes it impossible to fix this age at present, with accuracy. When this plan has been running for some years it may be possible to find healthy, mature trees in sufficient number to make the results obtained from their analyses conclusive, and if so the rotation of the sandal may be fixed; but this is at present impossible.

For the attainment of our object it is necessary therefore, in the first place, to encourage to the utmost the growth and spread of sandal in these forests, and in the second place to ensure its being allowed to continue growing so long as its rate of volume increment does not fall off.

29. *Method of treatment.*—The forests will therefore at present be subjected to annual improvement fellings, involving the extraction of dead and dying trees only. These fellings will take place over certain regularly recurring, defined areas, the whole forest being worked over once every six years.

30. *The exploitable age and size.*—As stated in paragraph 28 above, it is not possible now to fix the exploitable age and size of this species.

When Mr. Rama Rao prepared his preliminary Working Plan for Tirupathur Range, then in Salem district, he raised the minimum felling girth by 6 inches and clearly proved when he did so that the lower girth at which felling had taken place previous to the preparation of his plan had resulted in considerable loss of revenue. From perusal of his remarks on the subject it is evident that he was not at all confident that even his higher minimum would be sufficient, and this is without doubt the case, though what the correct figure may be we are not in a position to say even now owing to the lack of mature trees in the forest, already referred to.

CHAPTER III.

THE FELLINGS.

31. *Calculation of the possibility.*—From the conclusions arrived at in the last chapter it is obvious that the possibility of the forest cannot now be fixed. For, if the exploitable size of the species is not known, and mature trees are practically non-existent, it is only possible at present to prescribe the extraction of such trees as cannot affect the growing stock.

32. *Felling period.*—This being the case fellings are prescribed for a period of eighteen years only, consisting of three felling cycles of six years each, in the Four Working Circles in the Javadis, and of six felling cycles of three years each, in the Yelagiris Working Circle.

At the end of every felling cycle the Working Plan should be revised by the Working Plans staff; and before the felling period is quite completed, that is to say not later than about 1933 a new Working Plan must be drawn up. By this time sufficient data should have been collected, provided the control registers are properly maintained, to make it possible to fix the best financial rotation of the sandal and calculate the possibility of the forest, and so prepare a more permanent Working Plan.

33. *Areas to be felled annually; order of their allotment.*—The sub-division into annual coupes has been made principally on a basis of area; and an endeavour has been made to form these coupes so that they contain more than one and less than two thousand acres each. When however, an area is found that contains an abnormally rich stock of sandal it has been necessary to reduce the size of the coupe in order to permit of efficient working; and on the other hand, where the stock is

unusually poor larger areas have been adopted. The boundaries, of the Felling Series and of the coupes correspond either with lines already existing on the ground, or with the new sandal stock boundary which must be cut on the ground (*vide* maps numbers 1 and 3); or else they follow well marked foot-paths, or streams. Lines ten feet wide to mark the coupe boundaries must be cut in all cases in the year prior to felling. This will cost some Rs. 6 per mile working out to an average expenditure of about Rs. 300 per annum on clearing coupe lines. The sub-division into coupes has been largely made from the maps, as to go over all the lines would involve an unnecessary waste of time. If then it is found that any of the streams adopted do not actually exist on the ground,—owing to inaccuracies in survey,—*straight* lines must be cut through the forest to join up the points in question.

The order of felling has been arranged, as far as possible, in accordance with previous working. At the end of the first Felling Cycle, that is to say after the end of 1920–21, the whole forest in the Javadis will have been worked over once, and then the first coupes will be taken in hand again. In the Yelagiris the first felling cycle will have been completed at the end of 1917–18, and in 1918–19 the second cycle will commence.

The felling period comprises three Felling Cycles in the case of the four Working circles in the Javadis and six felling cycles in the Yelagiris Working Circle. In the Tirupattur Working Circle the coupes do not include those portions of the unreserves which have not now been proposed for further reservation. In cases where such unreserves contain sandal they will be worked at the same time as the adjoining coupes. This rule will also apply to any sandal that is found on cultivated lands not included in the coupes throughout the Javadis and Yelagiris with the exception of the trees present on lands in the Tirupattur Working Circle for which pattas were granted prior to 1906, since such trees do not belong to Government. And in these cases, in order to prevent fraud, the trees must be bought by Government whenever the pattadars desire to dispose of them as pointed out in paragraph 8 above.

34. *Nature of and mode of executing the fellings.*—As explained above it is necessary that during the period of this Working Plan improvement fellings only shall take place. These will consist in the removal from the successive annual coupes of all dead and dying trees. Of these two classes only the dead trees will be removed in the year of felling, those that are dying being then girdled and left to die and dry for two years, after which time they also will be extracted. In this way the star cracking, due to too rapid dryage, which now so greatly detracts from the value of our best billets will, it is hoped, be obviated; and also the quality of the wood will be enhanced; for trees that die naturally are found to contain a greater percentage of heartwood than healthy trees, and it is considered probable that the same condition may be induced by killing the trees artificially while still standing. Moreover with many species it is the case that girdling induces rapid reproduction by root shoots and if this is the case with sandal, such roots as have produced suckers may be separated from the parent stem and left to grow when the final extraction of the girdled trees takes place. This appears to me however to be a matter of minor importance as reproduction by seed is so good in the Javadis that it alone may well be relied upon to give us our regeneration. This prescription is intended to be purely experimental, and if the gain in quantity and quality of the heartwood yielded is not found to be as great as is expected, it should be abandoned and the extraction by uprooting of both classes of wood completed in the year of felling. If this is done the trees that were not dead should be *fully dried* before being auctioned as green wood commands a lower price than dry wood. The girdling should be taken up directly sanction is obtained as this can be done while the weather is still dry, whereas the uprooting cannot commence until the soil has become sufficiently wet to permit of easy working.

Fully detailed felling rules are given in Appendix II.

After felling and preliminary dressing has been completed in the forest the wood will be transported to the sale depots where it will be checked, finally cleaned, classified and auctioned.

35. *Tabular Statement of Felling.*

Felling series.			Coupes.						Remarks.
Name.	Area.	Number of trees present.	Years of felling and girdling.	Year of extraction of girdled trees.	Coupe number.	Total area.	* Area containing no sandal.	† Number of trees.	
			SANTHAVASAL WORKING CIRCLE.						
			1915-16 1921-22 1927-28	1917-18 1923-24 1929-30	I	1,627	629	6,700	
A.—Thongamalai series including—			1916-17 1922-23 1928-29	1918-19 1924-25 1930-31	II	1,705	42	6,967	
Thongamalai enclosure ...	3,667	9,073	1917-18 1923-24 1929-30	1919-20 1925-26 1931-32	III	1,219	101	11,152	
Puthur Reserve Forest (portion)	1,753	20,918	1918-19 1924-25 1930-31	1920-21 1926-27 1932-33	IV	1,411	275	11,920	
Arasampattu Reserve Forest ...	2,575	34,355	1919-20 1925-26 1931-32	1921-22 1927-28 1933-34	V	904	...	13,196	
			1920-21 1926-27 1932-33	1922-23 1928-29 1934-35	VI	1,129	...	14,411	
Total ...	7,995	64,346				7,995	1,047	64,346	
			1915-16 1921-22 1927-28	1917-18 1923-24 1929-30	I	1,597	...	11,204	
B.—Amerdi series including—			1916-17 1922-23 1928-29	1918-19 1924-25 1930-31	II	1,505	...	13,519	
Tellai Reserve Forest (portion)	3,086	17,190	1917-18 1923-24 1929-30	1919-20 1925-26 1931-32	III	1,770	...	15,086	
Puthur Reserve Forest (portion)	4,542	64,801	1918-19 1924-25 1930-31	1920-21 1926-27 1932-33	IV	848		13,827	
Amerdi Plantation (a small portion of this plantation lies in Malayalam Reserve Forest)			1919-20 1925-26 1931-32	1921-22 1927-28 1933-34	V	866	...	16,705	
	26	1,802	1920-21 1926-27 1932-33	1922-23 1928-29 1934-35	VI	1,068	...	13,452	
Total ...	7,654	83,793				7,654	...	83,793	
			1915-16 1921-22 1927-28	1917-18 1923-24 1929-30	I	882	...	8,273	
C.—Nadanur series including— Puthur Reserve Forest (portion)	7,413	27,675	1916-17 1922-23 1928-29	1918-19 1924-25 1930-31	II	837	...	8,168	
Malayalam Reserve Forest ...	1,303	6,839	1917-18 1923-24 1929-30	1919-20 1925-26 1931-32	III	1,585	...	2,953	A large part of this coupe consists of Nadanur enclosure on which the sandal stock is poor; hence its large area.
Tellai Reserve Forest (portion)	122	590	1918-19 1924-25 1930-31	1920-21 1926-27 1932-33	IV	2,284	...	3,885	
			1919-20 1925-26 1931-32	1921-22 1927-28 1933-34	V	1,947	...	4,986	
			1920-21 1926-27 1932-33	1922-23 1928-29 1934-35	VI	1,303	...	6,839	
Total ...	‡8,838	35,104				8,838	...	35,104	
Grand total ...	24,487	183,243				24,487	1,047	183,243	

* The area containing "no sandal" is left uncoloured in the stock map.

† The number of trees in each coupe is calculated according to the average number per acre found by actual enumerations in each locality.

‡ In order to include some scattered blocks of sandal the boundary of this Felling Series on the map includes a large blank area which lies outside the stock line; this has not been included in the area of the Felling Series.

Felling series.			Coupes.						Remarks.
Name.	Area.	Number of trees present.	Years of felling and girdling.	Year of extraction of girdled trees.	Coupe number.	Total area.	* Area containing no sandal.	† Number of trees.	
POLUR WORKING CIRCLE.									
A.—Veerappanoor series including—Veerappanoor Reserve Forest (portion) ...	8,169	61,215	1915-16 1921-22 1927-28	1917-18 1923-24 1929-30	I	1,668	90	8,668	
			1916-17 1922-23 1928-29	1918-19 1924-25 1930-31	II	948	...	6,681	The density of sandal stock necessitates the smaller area.
			1917-18 1923-24 1929-30	1919-20 1925-26 1931-32	III	726	190	13,419	
			1918-19 1924-25 1930-31	1920-21 1926-27 1932-33	IV	749	38	11,353	
			1919-20 1925-26 1931-32	1921-22 1927-28 1933-34	V	2,208	203	9,947	The large size of the coupe is compensated for by the comparative poorness of sandal stock.
			1920-21 1926-27 1932-33	1922-23 1928-29 1934-35	VI	1,870	130	11,147	
Total ...	8,169	61,215				8,169	651	61,215	
B. Patraikad series including—Patraikad Reserve Forest ...	10,327	63,025	1915-16 1921-22 1927-28	1917-18 1923-24 1929-30	I	1,861	...	11,835	
Mulacad Reserve Forest ...	1,625	7,452	1916-17 1922-23 1928-29	1918-19 1924-25 1930-31	II	1,947	...	11,662	
			1917-18 1923-24 1929-30	1919-20 1925-26 1931-32	III	1,858	...	11,492	
			1918-19 1924-25 1930-31	1920-21 1926-27 1932-33	IV	2,481	127	11,988	The large size of the coupe is compensated for by the comparative poorness of sandal stock.
			1919-20 1925-26 1931-32	1921-22 1927-28 1933-34	V	2,413	...	12,108	
			1920-21 1926-27 1932-33	1922-23 1928-29 1934-35	VI	1,392	...	11,392	
Total ...	‡ 11,952	70,477				11,952	127	70,477	
C. Komuttiyore series including—Komuttiyore enclosure ...	5,781	27,753	1915-16 1921-22 1927-28	1917-18 1923-24 1929-30	I	3,056	75	10,681	The stock of sandal being very poor, the area of the coupe has been increased.
Veerappanoor Reserve Forest (portion) including A, B & C blocks.	5,058	49,954	1916-17 1922-23 1928-29	1918-19 1924-25 1930-31	II	2,689	...	11,980	
			1917-18 1923-24 1929-30	1919-20 1925-26 1931-32	III	1,436	...	12,019	
			1918-19 1924-25 1930-31	1920-21 1926-27 1932-33	IV	669	...	13,088	
			1919-20 1925-26 1931-32	1921-22 1927-28 1933-34	V	1,828	...	13,667	
			1920-21 1926-27 1932-33	1922-23 1928-29 1934-35	VI	1,161	...	12,272	
Total ...	10,839	73,707				10,839	75	73,707	
Grand total ...	30,960	205,399				30,960	...	205,399	

* The area containing " no sandal " is left uncoloured in the stock map.

† The number of trees in each coupe is calculated according to the average number per acre found by actual enumerations to be present in each locality.

‡ In order to include some scattered blocks of sandal the boundary of the Felling Series on the map includes a large blank area which lies outside the stock line; this has not been included in the area of the Felling Series.

Felling series.			Coupes.						Remarks.
Name.	Area.	Number of trees present.	Years of felling and girdling.	Year and extraction of girdled trees.	Coupe number.	Total area.	* Area containing no sandal.	† Number of trees.	
CHENGAM WORKING CIRCLE.									
A. Pelamaruthur Series including—			1915-16 1921-22 1927-28	1917-18 1923-24 1929-30	I	1,784	...	4,377	
Pelamaruthur Reserve Forest	1,890	1,474	1916-17 1922-23 1928-29	1918-19 1924-25 1930-31	II	1,811	...	3,837	
Pelamaruthur Unreserve	5,413	13,824	1917-18 1923-24 1929-30	1919-20 1925-26 1931-32	III	1,883	550	4,935	
Nallappattu Reserve Forest (portion).	4,162	13,165	1918-19 1924-25 1930-31	1920-21 1926-27 1932-33	IV	1,944	105	5,316	
			1919-20 1925-26 1931-32	1921-22 1927-28 1933-34	V	1,675	...	5,288	
			1920-21 1926-27 1932-33	1922-23 1928-29 1934-35	VI	2,368	...	4,710	The large size of the coupe is compensated for by the comparative poorness of sandal stock.
Total ...	11,465	28,463				11,465	655	28,463	
B. Melpattu Series including—			1915-16 1921-22 1927-28	1917-18 1923-24 1929-30	I	1,129	...	8,211	
Tenmalai Reserved Forest (portion).	5,860	49,647	1916-17 1922-23 1928-29	1918-19 1924-25 1930-31	II	833	...	12,155	
			1917-18 1923-24 1929-30	1919-20 1925-26 1931-32	III	956	...	10,806	
			1918-19 1924-25 1930-31	1920-21 1926-27 1932-33	IV	986	...	5,046	
			1919-20 1925-26 1931-32	1921-22 1927-28 1933-34	V	1,065	100	5,345	
			1920-21 1926-27 1932-33	1922-23 1928-29 1934-35	VI	891	...	8,084	
Total ...	5,860	49,647				5,860	100	49,647	
C. Nellivoi Series including—			1915-16 1921-22 1927-28	1917-18 1923-24 1929-30	I	1,129	...	2,940	
Nallappattu Reserve Forest (portion).	932	2,412	1916-17 1922-23 1928-29	1918-19 1924-25 1930-31	II	883	...	2,502	
Tenmalai Reserve Forest (portion).	5,101	17,793	1917-18 1923-24 1929-30	1919-20 1925-26 1931-32	III	735	...	3,971	
			1918-19 1924-25 1930-31	1920-21 1926-27 1932-33	IV	876	...	4,144	
			1919-20 1925-26 1931-32	1921-22 1927-28 1933-34	V	1,138	...	3,050	
			1920-21 1926-27 1932-33	1922-23 1928-29 1934-35	VI	1,272	...	3,598	
Total ...	6,033	20,205				6,033	...	20,205	
Grand total ...	23,358	98,315				23,358	...	98,315	

* The area containing "no sandal" is left uncoloured in the stock map.

† The number of trees in each coupe is calculated according to the average number per acre found by actual enumeration to be present in each locality.

Felling series.			Coupes.						Remarks.
Name.	Area.	Number of trees present.	Years of felling and girdling.	Year of extraction of girdled trees.	Coupe number.	Total area.	* Area containing no sandal.	† Number of trees.	
TIRUPPATTUR WORKING CIRCLE.									
A. Kambagudi Series including—			1915–16 1921–22 1927–28	1917–18 1923–24 1929–30	I	1,974	...	7,033	This coupe consists of two parts one included in Andiappanoor Reserve Forest and the other a small detached block around Kodukamalai enclosure.
			1916–17 1922–23 1928–29	1918–19 1924–25 1930–31	II	2,062	...	4,374	This coupe includes a small detached block lying south-east of Reddiyore (*vide* Survey of India, sheet 3).
Kambagudi Unreserve (proposed blocks).	1,955	18,783	1917–18 1923–24 1929–30	1919–20 1925–26 1931–32	III	980	...	9,590	
Andiappanoor Reserve Forest.	3,882	9,422	1918–19 1924–25 1930–31	1920–21 1926–27 1932–33	IV	1,129	...	11,073	
Inner Javadis Reserve Forest (portion).	1,188	26,152	1919–20 1925–26 1931–32	1921–22 1927–28 1933–34	V	494	...	11,158	The density of sandal stock necessitates the smaller area.
			1920–21 1926–27 1932–33	1922–23 1928–29 1934–35	VI	386	...	11,129	
Total ...	‡ 7,025	54,357				7,025	...	54,357	
B. Mambakkam Series including—			1915–16 1921–22 1927–28	1917–18 1923–24 1929–30	I	1,125	...	7,095	
			1916–17 1922–23 1928–29	1918–19 1924–25 1930–31	II	1,433	...	8,431	
Mambakkam Reserve Forest (portion).	2,189	23,977	1917–18 1923–24 1929–30	1919–20 1925–26 1931–32	III	1,958	210	9,097	
Inner Javadis Reserve Forest (portion).	4,516	24,623	1918–19 1924–25 1930–31	1920–21 1926–27 1932–33	IV	580	...	8,315	The density of sandal stock necessitates the smaller area.
			1919–20 1925–26 1931–32	1921–22 1927–28 1933–34	V	812	...	8,132	
			1920–21 1926–27 1932–33	1922–23 1928–29 1934–35	VI	797	...	7,530	
Total ...	6,705	48,600				6,705	210	48,600	
C. Pudur Series including—			1915–16 1921–22 1927–28	1917–18 1923–24 1929–30	I	1,642	...	8,437	
Mambakkam Reserve Forest (portion).	3,715	22,758	1916–17 1922–23 1928–29	1918–19 1924–25 1930–31	II	1,556	...	9,052	
Puliyore Unreserve proposed blocks I, II & IV.	2,233	23,113	1917–18 1923–24 1929–30	1919–20 1925–26 1931–32	III	1,318	...	9,621	
Mambakkam Unreserve.	582	1,524	1918–19 1924–25 1930–31	1920–21 1926–27 1932–33	IV	1,254	...	9,914	
Inner Javadis Reserve Forest (portion).	498	9,964	1919–20 1925–26 1931–32	1921–22 1927–28 1933–34	V	719	35	9,800	The density of sandal stock necessitates the smaller area.
			1920–21 1926–27 1932–33	1922–23 1928–29 1934–35	VI	539	...	10,535	
Total ...	7,028	57,359				7,028	35	57,359	

* The area containing "no sandal" is left uncoloured in the stock map.

† The number of trees in each coupe is calculated according to the average number per acre found by actual enumeration to be present in each locality.

‡ In order to include some scattered blocks of sandal the boundary of this Felling Series on the map includes a large blank area which lies outside the stock line; this has not been included in the area of the Felling Series.

Felling series.			Coupes.						Remarks.
Name.	Area.	Number of trees present.	Years of felling and girdling.	Year of extraction of girdled trees.	Coupe number.	Total area.	* Area containing no sandal.	† Number of trees.	
TIRUPATTUR WORKING CIRCLE—*cont.*									
D. Puliyore Series including—			1915-16 1921-22 1927-28	1917-18 1923-24 1929-30	I	925	...	9,610	
Inner Javadis Reserve Forest (portion).	3,074	13,286	1916-17 1922-23 1928-29	1918-19 1924-25 1930-31	II	1,166	...	9,074	
Puliyore Unreserve proposed blocks III, V, VI & VII.	2,182	24,064	1917-18 1923-24 1929-30	1919-20 1925-26 1931-32	III	1,112	...	8,921	
Singarapet Reserve Forest.	2,578	5,015	1918-19 1924-25 1930-31	1920-21 1926-27 1932-33	IV	2,329	...	9,169	The large size of this coupe is compensated for by the comparative poorness of sandal stock.
Singarapet Extension Reserve Forests.	1,560	10,835	1919-20 1925-26 1931-32	1921-22 1927-28 1933-34	V	1,284	...	11,411	
			1920-21 1926-27 1932-33	1922-23 1928-29 1934-35	VI	2,578	342	5,015	The large size of this coupe is compensated for by the comparative poorness of sandal stock.
Total ...	‡ 9,394	53,200				9,394	342	53,200	
Grand total ...	30,152	213,516				30,152	...	213,516	
THE YELAGIRI WORKING CIRCLE.									
A. Athanur Series including—			1915-16 1918-19 1921-22 1924-25 1927-28 1930-31	1917-18 1920-21 1923-24 1926-27 1929-30 1932-33	I	535	...	16,853	
Jalarpet Reserve Forest.	1,370	48,313	1916-17 1919-20 1922-23 1925-26 1928-29 1931-32	1918-19 1921-22 1924-25 1927-28 1930-31 1933-34	II	545	...	18,341	
Unreserves ...	168	2,388	1917-18 1920-21 1923-24 1926-27 1929-30 1932-33	1919-20 1922-23 1925-26 1928-29 1931-32 1934-35	III	458	...	15,507	
Total ...	‡ 1,538	50,701				1,538	...	50,701	
B. Kottur Series including—			1915-16 1918-19 1921-22 1924-25 1927-28 1930-31	1917-18 1920-21 1923-24 1926-27 1929-30 1932-33	I	664	...	15,618	
Nagalathu Reserve Forest.	1,506	36,121	1916-17 1919-20 1922-23 1925-26 1928-29 1931-32	1918-19 1921-22 1924-25 1927-28 1930-31 1933-34	II	739	...	15,975	
Nagalathu Extension Reserve Forest.	123	356	1917-18 1920-21 1923-24 1926-27 1929-30 1932-33	1919-20 1922-23 1925-26 1928-29 1931-32 1934-35	III	705	...	12,381	
Mangalam Extension Reserve Forest.	201	3,346							
Unreserves ...	278	4,151							
Total ...	‡ 2,108	43,974				2,108	...	43,974	
Grand total ...	3,646	94,675				3,646	...	94,675	

* The area containing " no sandal " is left uncoloured in the stock map.

† The number of trees in each coupe is calculated according to the average number per acre found by actual enumeration to be present in each locality.

‡ In order to include some scattered blocks of sandal the boundary of this Felling Series on the map includes a large blank area which lies outside the stock line; this has not been included in the area of the Felling Series.

36. *Forecast of condition of crops at the expiry of felling period*.—After the eighteen years that this Working-Plan is to run, provided the sandal register prescribed in paragraph 44 has been correctly maintained, there should be sufficient data available for it to be possible to fix the best financial rotation of the sandal for these forests; moreover there will be by that time, as far as can now be estimated, a large number of mature trees ready for felling, though there will still be a deficiency in the higher girth classes. This deficiency will however decrease with every year of systematic working until a forest as nearly normal as is, in practical forestry, possible will be obtained. What the number of mature sandal trees is that an acre of average soil can support, it is obviously impossible under present conditions to state. It is however permissible to assume that the condition of the growth present is more or less normal for trees below 36″ in girth or say, 11″ in diameter, as this is the minimum girth prescribed, for fellings to take place under recent Working-Plans. On this assumption calculations have been made, taking the figures for the diameter classes found to be actually present in the reserved forests by the enumerations made in the preparation of this Working-Plan and a curve has been drawn showing the decrease that takes place in the number of trees present per acre as the diameter increases up to 11 inches. A prolongation of this curve shows the number of trees per acre that may be expected to survive under present conditions as the diameters increase from 11 up to 18 inches (*vide* Graph No. 1 in Appendix X). It is considered probable that in the future it will be found that it is at about 15 inches in diameter that the average tree will reach maturity and that felling should take place, and we see from our graph that we may expect an average of four such trees to the hundred acres (*vide* Graph No. 1 in Appendix X). This is under present conditions. But under this Working-Plan tending the growing stock and assisting natural regeneration is prescribed and we may therefore expect a much greater proportion of trees to survive until maturity. It is considered then that a fair estimate of the future yield will be six mature trees (*i.e.*, trees of 15″ diameter) to the hundred acres. Taking the average weight of heartwood contained in such a tree as 25 quarters (*vide* Graph No. 2 in Appendix X) we find that this gives us an average yield of 1½ quarters of sandal heartwood per acre from this major crop, that is to say from the living mature trees alone. In the Javadis the average size of a coupe is approximately 1,400 acres and 13 such coupes are felled per annum. We can therefore expect an *annual* yield of 27,300 quarters of heartwood from the living mature trees.

The calculation of the yield that may be expected from the trees that die before attaining maturity is more difficult. Such a calculation has however been attempted (*vide* Calculation No. 1 in Appendix VII) and it is found that an annual yield of approximately 7,000 quarters may be expected from this minor crop. If then the prescriptions of this Working-Plan are carried out, when the forest is in full bearing, we will get an annual yield of at least 34,300 quarters of sandal heartwood. During the Felling Period and immediately after its close, the yield will not be as large.

But from calculations made on the data available it appears probable that during the period of the Working-Plan the *average* annual yield of heartwood will be not less than 10,400 quarters; at the beginning of the felling period the yield will probably be less than this amount, increasing towards the end of the period until it is greater. During the next Felling Cycle, if it then is considered advisable to continue the working on lines similar to those prescribed in this Plan, with the added extraction of living trees 15″ in diameter and over,—the annual yield will be not less than 18,500 quarters. (For the calculations giving these results, *vide* Calculation II in Appendix VII.)

The conclusion arrived at then is that during the Felling Period prescribed in this Working-Plan the *average annual* yield of sandal heartwood will be about 10,400 quarters increasing to 18,500 quarters during the Felling Cycle immediately following; after that rapidly rising to a maximum of 34,300 quarters and thereafter remaining stationary, or increasing as the sandalwood spreads.

But again the fact is emphasized that these estimates cannot, owing to lack of reliable data, be accurate and that the calculations are made largely on

probabilities. They are however more likely to have erred on the side of under-estimating than of over-estimating the possibility of the forest.

The forests of the Yelagiris Working Circle have not been included in these calculations as they are still very immature.

CHAPTER IV.

SUPPLEMENTARY REGULATIONS.

37. *Cleaning and tending.*—Tending the crop is of very great importance and it has been neglected up to date. The tending of each coupe will be done in the year following that of felling. This work may most usefully be taken in hand during the hot weather when, owing to the fact that the Malayalis are not engaged in cultivation of any sort, labour is plentiful, and when felling operations in other coupes are not in progress. The work will consist in freeing the crowns of sandal trees—and also of such of their hosts as may need it—from creepers; and in cutting down trees that are interfering with the free development of the sandal. While doing this however, the fact must be borne in mind that during its youth sandal needs plenty of shade, more especially lateral shade, becoming more light-demanding as it gets older. Saplings must be helped, if they are being suppressed, by *cutting back* the growth that is interfering with them, but on no account must such growth be *uprooted* as it is quite possible that it may be serving as host to the parasitic sandal roots.

This fact must also be remembered when freeing the crowns of the older trees, and no possible host must be destroyed. This operation will cost 6 pies per acre.

As well as this general tending, areas on which the growth of young sandal is particularly promising should be selected in each coupe and specially protected. Such areas may vary from twenty-five to fifty or one hundred acres in extent and must be rigidly protected from all grazing and from fire; and in them special attention must be paid to assisting regeneration (*vide* paragraph 38 below) and to cleanings and creeper cuttings. These areas must be "tended" and watched until the young growth is out of all danger of suppression. A fire-line 30 feet wide must be made round each of these specially protected blocks by *uprooting* all growth on them in the year of formation. This can be done for Rs. 30 a mile. In subsequent years such fire-lines need very little attention, and their upkeep can be entrusted to the neighbouring Malayalis in return for grazing concessions and fire protection rewards, as outlined in paragraph 39 and at the end of paragraph 40. In addition to this permanent fire-line they must be protected by a substantial fence (or wall if stone is plentiful) constructed on the inside of the fire-line. A suitable fence can be cheaply made by driving into the ground two rows of stakes projecting 5 feet above the ground, the two rows being 5 feet apart, and filling in the intervening space with small bamboos laid longitudinally and pressed down. Cattle cannot get through such a fence and it will last for years. It will cost some Rs. 10 per furlong.

The tending of these specially protected blocks will cost $1\frac{1}{2}$ annas per acre the first year and in subsequent years about 6 pies per acre. In the estimate of cost appended it is assumed that this tending will not continue for more than the length of the Felling Cycle. In certain of these areas, in easily accessible places (*e.g.*, in the Yelagiris, at Kambugudi, Komuttiyore or Patrakad, or in the Amerdi plantation) sample plots of one or two acres in extent should be marked off; all the trees on them including seedlings and saplings enumerated, marked with a band of black enamel and numbered; and the height and girth measurements recorded every year in a register maintained for the purpose; this is in order that reliable data for the rate of growth of sandal may be obtained, and its general development more closely watched than has been possible hitherto.

It is of course necessary that the District Forest Officer should pay personal attention to this matter and himself measure the sample plots in as many cases as is possible. The position of these sample areas as well as of the specially protected blocks must be marked on the control map with the date of selection and of subsequent tendings. Portions of enclosures and unreserves which form parts of coupes should not be subjected to "Tending" operations. A tabular statement showing areas to be worked annually with an estimate of cost is appended.

Year.	Felling series.	First tending number of coupe.	Area of coupe in acres.	Area of enclosure included in coupe in acres.	Area to be tended in acres, column 4 —column 5.	Cost at ½ anna per acre.	Specially protected blocks average about 50 acres each. Number of coupe.	Area.	Cost Per acre.	Cost Total.	Cost of formation of permanent fire-line.	Total cost.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(10)	(11)	(12)
						RS. A. P.			RS. A. P.	RS. A. P.	RS. A. P.	RS. A.
							SANTHAVASAL WORKING CIRCLE.					
1916-17	A	I	1,627	1,016	611	19 1 6	I	50	0 1 6	4 11 0	7 8 0	128 3 0
	B	I	1,597	..	1,597	49 14 6	I	50	0 1 6	4 11 0	7 8 0	
	C	I	882	158	724	22 10 0	I	50	0 1 6	4 11 0	7 8 0	
1917-18	A	II	1,705	1,264	441	13 12 6	II	50	0 1 6	4 11 0	7 8 0	121 5 6
							I	50	0 0 6	1 9 0	...	
	B	II	1,505	220	1,285	40 2 6	II	50	0 1 6	4 11 0	7 8 0	
							I	50	0 0 6	1 9 0	...	
	C	II	837	...	837	26 2 6	II	50	0 1 6	4 11 0	7 8 0	
							I	50	0 0 6	1 9 0	...	
1918-19	A	III	1,219	581	638	19 15 0	III	50	0 1 6	4 11 0	7 8 0	122 8 0
							I, II.	100	0 0 6	3 2 0	...	
	B	III	1,770	220	1,550	48 7 0	III	50	0 1 6	4 11 0	7 8 0	
							I, II.	100	0 0 6	3 2 0	...	
	C	III	1,585	1,323	262	8 3 0	III	50	0 1 6	4 11 0	7 8 0	
							I, II.	100	0 0 6	3 2 0	...	
1919-20	A	IV	1,411	847	564	17 10 0	IV	50	0 1 6	4 11 0	7 8 0	97 10 6
							I, II, III.	150	0 0 6	4 11 0	...	
	B	IV	848	262	586	18 5 0	IV	50	0 1 6	4 11 0	7 8 0	
							I, II, III.	150	0 0 6	4 11 0	...	
	C	IV	2,284	1,929	355	11 1 6	IV	50	0 1 6	4 11 0	7 8 0	
							I, II, III.	150	0 0 6	4 11 0	...	
1920-21	A	V	904	...	904	28 4 0	V	50	0 1 6	4 11 0	7 8 0	138 8 6
							I, II, III, IV.	200	0 0 6	6 4 0	...	
	B	V	866	...	866	27 1 0	V	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV.	200	0 0 6	6 4 0	...	
	C	V	1,947	1,054	893	27 14 6	V	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV.	200	0 0 6	6 4 0	...	
1921-22	A	VI	1,129	134	995	31 1 6	VI	50	0 1 6	4 11 0	7 8 0	143 13 6
							I, II, III, IV, V.	250	0 0 6	7 13 0	...	
	B	VI	1,068	45	1,023	31 15 6	VI	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV, V.	250	0 0 6	7 13 0	...	
	C	VI	1,303	638	665	20 12 6	VI	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV, V.	250	0 0 6	7 13 0	..	
1922-23	A	I	1,627	1,016	611	19 1 6	I	50	0 1 6	4 11 0	7 8 0	151 10 6
							II, III, IV, V, VI.	250	0 0 6	7 13 0	...	
	B	I	1,597	...	1,597	49 14 6	I	50	0 1 6	4 11 0	7 8 0	
							II, III, IV, V, VI.	250	0 0 6	7 13 0	...	
	C	I	882	158	724	22 10 0	I	50	0 1 6	4 11 0	7 8 0	
							II, III, IV, V, VI.	250	0 0 6	7 13 0	...	
1923-24	A	II	1,705	1,264	441	13 12 6	II	50	0 1 6	4 11 0	7 8 0	140 1 6
							III, IV, V, VI, I	250	0 0 6	7 13 0	...	
	B	II	1,505	220	1,285	40 2 6	II	50	0 1 6	4 11 0	7 8 0	
							III, IV, V, VI, I.	250	0 0 6	7 13 0	...	
	C	II	837	...	837	26 2 6	II	50	0 1 6	4 11 0	7 8 0	
							III, IV, V, VI, I.	250	0 0 6	7 13 0	...	
1924-25	A	III	1,219	581	638	19 15 0	III	50	0 1 6	4 11 0	7 8 0	136 9 0
							IV, V, VI, I, II.	250	0 0 6	7 13 0	...	
	B	III	1,770	220	1,550	48 7 0	III	50	0 1 6	4 11 0	7 8 0	
							IV, V, VI, I, II.	250	0 0 6	7 13 0	...	
	C	III	1,585	1,323	262	8 3 0	III	50	0 1 6	4 11 0	7 8 0	
							IV, V, VI, I, II.	250	0 0 6	7 13 0	...	

Year.	Felling series.	First tending number of coupe.	Area of coupe in acres.	Area of enclosure included in coupe in acres.	Area to be tended in acres, column 4—column 5.	Cost at 1/3 anna per acre.	Specially protected blocks average about 50 acres each. Number of coupe.	Acres.	Cost. Per acre.	Cost. Total.	Cost of formation of permanent fire-line.	Total cost.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(10)	(11)	(12)
							SANTHAVASAL WORKING CIRCLE—*cont.*					
						RS. A. P.			RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
1925-26	A	IV	1,411	847	564	17 10 0	IV	50	0 1 6	4 11 0	7 8 0	107 0 6
							V, VI, I, II, III.	250	0 0 6	7 13 0	...	
	B	IV	848	262	586	18 5 0	IV	50	0 1 6	4 11 0	7 8 0	
							V, VI, I, II, III.	250	0 0 6	7 13 0	...	
	C	IV	2,284	1,929	355	11 1 6	IV	50	0 1 6	4 11 0	7 8 0	
							V, VI, I, II, III.	250	0 0 6	7 13 0	...	
1926-27	A	V	904	...	904	28 4 0	V	50	0 1 6	4 11 0	7 8 0	143 13 6
							VI, I, II, III, IV.	250	0 0 6	7 13 0	...	
	B	V	866	...	866	27 1 0	V	50	0 1 6	4 11 0	7 8 0	
							VI, I, II, III, IV.	250	0 0 6	7 13 0	...	
	C	V	1,947	1,054	893	27 14 6	V	50	0 1 6	4 11 0	7 8 0	
							VI, I, II, III, IV.	250	0 0 6	7 13 0	...	
1927-28...	...	...	...	...	...	As in the year 1921-22 ...			..	..	...	143 13 6
1928-29...	...	...	...	...	...	As in the year 1922-23 ...			...	...	...	151 10 0
1929-30 ..	...	...	...	...	...	As in the year 1923-24 ...			...	...	...	140 1 6
1930-31...	...	...	...	...	...	As in the year 1924-25 ...			...	...	...	136 9 0
1931-32...	...	...	...	...	...	As in the year 1925-26 ...			...	...	...	107 0 6
1932-33...	..	...	...	...	...	As in the year 1926-27 ...			...	...	...	143 3 6
											Total ...	2,252 15 6
											Average per annum ...	125 2 8
							POLUR WORKING CIRCLE.					
1916-17	A	I	1,668	74	1,594	49 13 0	I	50	0 1 6	4 11 0	7 8 0	196 13 0
	B	I	1,861	58	1,803	56 5 6	I	50	0 1 6	4 11 0	7 8 0	
	C	I	3,056	1,325	1,731	54 1 6	I	50	0 1 6	4 11 0	7 8 0	
1917-18	A	II	948	...	948	29 10 0	II	50	0 1 6	4 11 0	7 8 0	163 4 6
							I	50	0 0 6	1 9 0		
	B	II	1,947	143	1,804	56 6 0	II	50	0 1 6	4 11 0	7 8 0	
							I	50	0 0 6	1 9 0	...	
	C	II	2,689	1,536	1,153	36 0 6	II	50	0 1 6	4 11 0	7 8 0	
							I	50	0 0 6	1 9 0	...	
1918-19	A	III	726	25	701	21 14 6	III	50	0 1 6	4 11 0	7 8 0	126 9 0
							I, II.	100	0 0 6	3 2 0	...	
	B	III	1,850	189	1,669	52 2 6	III	50	0 1 6	4 11 0	7 8 0	
							I, II.	100	0 0 6	3 2 0	...	
	C	III	1,436	1,226	210	6 9 0	III	50	0 1 6	4 11 0	7 8 0	
							I, II.	100	0 0 6	3 2 0	...	
1919-20	A	IV	749	277	472	14 12 0	IV	50	0 1 6	4 11 0	7 8 0	154 13 0
							I, II, III.	150	0 0 6	4 11 0	...	
	B	IV	2,481	28	2,453	76 10 6	IV	50	0 1 6	4 11 0	7 8 0	
							I, II, III.	150	0 0 6	4 11 0	...	
		IV	669	260	409	12 12 6	IV	50	0 1 6	4 11 0	7 8 0	
							I, II, III.	150	0 0 6	4 11 0	...	
1920-21	A	V	2,208	500	1,708	53 6 0	V	50	0 1 6	4 11 0	7 8 0	204 11 0
							I, II, III, IV.	200	0 0 6	6 4 0	...	
	B	V	2,413	81	2,332	72 14 0	V	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV.	200	0 0 6	6 4 0	...	
	C	V	1,828	1,088	740	23 2 0	V	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV.	200	0 0 6	6 4 0	...	
1921-22	A	VI	1,870	1,296	574	17 15 0	VI	50	0 1 6	4 11 0	7 8 0	165 9 6
							I, II. III, IV, V.	250	0 0 6	7 13 0	...	
	B	VI	1,392	67	1,325	41 6 6	VI	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV, V.	250	0 0 6	7 13 0	...	
	C	VI	1,161	421	740	46 4 0	VI	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV, V.	250	0 0 6	7 13 0	...	

Year.	Felling series.	First tending number of coupe.	Area of coupe in acres.	Area of enclosure included in coupe in acres.	Area to be tended in acres, column 4—column 5.	Cost at ½ anna per acre.	Specially protected blocks average about 50 acres each. Number of coupe.	Area.	Cost. Per acre.	Cost. Total.	Cost of formation of permanent fire-line.	Total cost.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(10)	(11)	(12)

POLUR WORKING CIRCLE—*cont.*

Year	Series	Coupe	Area	Enclosure	To be tended	RS. A. P.	Number of coupe	Area	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
1922–23	A	I	1,668	74	1,594	49 13 0	I	50	0 1 6	4 11 0	7 8 0	220 4 0
							II, III, IV, V, VI.	250	0 0 6	7 13 0	...	
	B	I	1,861	58	1,803	56 5 6	I	50	0 1 6	4 11 0	7 8 0	
							II, III, IV, V, VI.	250	0 0 6	7 13 0	...	
	C	I	3,056	1,325	1,731	54 1 6	I	50	0 1 6	4 11 0	7 8 0	
							II, III, IV, V, VI.	250	0 0 6	7 13 0	...	
1923–24	A	II	948	...	948	29 10 0	II	50	0 1 6	4 11 0	7 8 0	182 0 6
							III, IV, V, VI, I.	250	0 0 6	7 13 0	...	
	B	II	1,947	143	1,804	56 6 0	II	50	0 1 6	4 11 0	7 8 0	
							III, IV, V, VI, I.	250	0 0 6	7 13 0	...	
	C	II	2,689	1,536	1,153	36 0 6	II	50	0 1 6	4 11 0	7 8 0	
							III, IV, V, VI, I.	250	0 0 6	7 13 0	...	
1924–25	A	III	726	25	701	21 14 6	III	50	0 1 6	4 11 0	7 8 0	140 10 0
							IV, V, VI, I, II.	250	0 0 6	7 13 0	...	
	B	III	1,858	189	1,669	52 2 6	III	50	0 1 6	4 11 0	7 8 0	
							IV, V, VI, I, II.	250	0 0 6	7 13 0	...	
	C	III	1,436	1,226	210	6 9 0	III	50	0 1 6	4 11 0	7 8 0	
							IV, V, VI, I, II.	250	0 0 6	7 13 0	...	
1925–26	A	IV	749	277	472	14 12 0	IV	50	0 1 6	4 11 0	7 8 0	164 3 0
							V, VI, I, II, III.	250	0 0 6	7 13 0	...	
	B	IV	2,481	28	2,453	76 10 6	IV	50	0 1 6	4 11 0	7 8 0	
							V, VI, I, II, III.	250	0 0 6	7 13 0	...	
	C	IV	669	260	409	12 12 6	IV	50	0 1 6	4 11 0	7 8 0	
							V, VI, I, II, III.	250	0 0 6	7 13 0	...	
1926–27	A	V	2,208	500	1,708	53 6 0	V	50	0 1 6	4 11 0	7 8 0	209 6
							VI, I, II, III, IV.	250	0 0 6	7 13 0	...	
	B	V	2,413	81	2,332	72 14 0	V	50	0 1 6	4 11 0	7 8 0	
							VI, I, II, III, IV.	250	0 0 6	7 13 0	...	
	C	V	1,828	1,088	740	23 2 0	V	50	0 1 6	4 11 0	7 8 0	
							VI, I, II, III, IV.	250	0 0 6	7 13 0	...	
1927–28	A	VI	1,870	1,296	574	17 15 0	VI	50	0 1 6	4 11 0	7 8 0	* 165 9 6
							I, II, III, IV, V.	250	0 0 6	7 13 0	...	
	B	VI	1,392	67	1,325	41 6 6	VI	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV, V.	250	0 0 6	7 13 0	...	
	C	VI	1,161	421	740	46 4 0	VI	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV, V.	250	0 0 6	7 13 0	...	
1928–29	...	...	...	...	...	As in the year 1922–23		...	...	...	...	220 4 0
1929–30	...	...	...	...	...	As in the year 1923–24		...	...	...	...	182 0 6
1930–31	...	...	...	...	...	As in the year 1924–25		...	...	...	...	140 10 0
1931–32	...	...	...	...	...	As in the year 1925–26		...	...	...	...	164 3 0
1932–33	...	...	...	...	...	As in the year 1926–27		...	...	...	...	209 6 0
											Total ...	3,010 4 6
											Average annual cost ...	178 14 5

* As in the year 1921–22.

Year. (1)	Felling series. (2)	First tending. Number of coupe. (3)	Area of coupe in acres. (4)	Area of enclosure included in coupe in acres. (5)	Area to be tended in acres, column 4—column 5. (6)	Cost at ½ anna per acre. (7)	Specially protected blocks average about 50 acres each: Number of coupe. (8)	Area (9)	Cost. Per acre. (10)	Cost. Total.	Cost of formation of permanent fire-line. (11)	Total cost (12)
						RS. A. P.			RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
CHENGAM WORKING CIRCLE												
1916–17	A	I	1,784	870	914	28 9 0	I	50	0 1 6	4 11 0	7 8 0	113 6 6
	B	I	1,129	319	810	25 5 0	I	50	0 1 6	4 11 0	7 8 0	
	C	I	1,129	394	735	22 15 6	I	50	0 1 6	4 11 0	7 8 0	
1917–18	A	II	1,811	1,559	252	7 14 0	II	50	0 1 6	4 11 0	7 8 0	89 3 6
							I	50	0 0 6	1 9 0	...	
	B	II	833	290	543	16 15 6	II	50	0 1 6	4 11 0	7 8 0	
							I	50	0 0 6	1 9 0	...	
	C	II	883	143	740	23 2 0	II	50	0 1 6	4 11 0	7 8 0	
							I	50	0 0 6	1 9 0	...	
1918–19	A	III	1,883	576	1,307	40 13 6	III	50	0 1 6	4 11 0	7 8 0	135 3 0
							I, II	100	0 0 6	3 2 0	...	
	B	III	956	142	814	25 7 0	III	50	0 1 6	4 11 0	7 8 0	
							I, II	100	0 0 6	3 2 0	...	
	C	III	735	...	735	22 15 6	III	50	0 1 6	4 11 0	7 8 0	
							I, II	100	0 0 6	3 2 0	...	
1919–20	A	IV	1,944	...	1,944	60 12 0	IV	50	0 1 6	4 11 0	7 8 0	135 0 6
							I, II, III	150	0 0 6	4 11 0	...	
	B	IV	986	696	290	9 1 0	IV	50	0 1 6	4 11 0	7 8 0	
							I, II, III	150	0 0 6	4 11 0	...	
	C	IV	876	409	467	14 9 6	IV	50	0 1 6	4 11 0	7 8 0	
							I, II, III	150	0 0 6	4 11 0	...	
1920–21	A	V	1,675	823	852	26 10 0	V	50	0 1 6	4 11 0	7 8 0	136 13 0
							I, II, III, IV	200	0 0 6	6 4 0	...	
	B	V	1,065	447	618	19 5 0	V	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV	200	0 0 6	6 4 0	...	
	C	V	1,138	...	1,138	35 9 0	V	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV	200	0 0 6	6 4 0	...	
1921–22	A	VI	2,368	1,585	783	24 7 6	VI	50	0 1 6	4 11 0	7 8 0	140 0 6
							I, II, III, IV, V	250	0 0 6	7 13 0	...	
	B	VI	891	190	701	21 14 6	VI	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV, V	250	0 0 6	7 13 0	...	
	C	VI	1,272	195	1,077	33 10 6	VI	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV, V	250	0 0 6	7 13 0	..	
1922–23	A	I	1,784	870	914	28 9 0	I	50	0 1 6	4 11 0	7 8 0	136 13 6
							II, III, IV, V, VI	250	0 0 6	7 13 0	...	
	B	I	1,129	319	810	25 5 0	I	50	0 1 6	4 11 0	7 8 0	
							II, III, IV, V, VI	250	0 0 6	7 13 0	...	
	C	I	1,129	394	735	22 15 6	I	50	0 1 6	4 11 0	7 8 0	
							II, III, IV, V, VI	250	0 0 6	7 13 0	...	
1923–24	A	II	1,811	1,559	252	7 14 0	II	50	0 1 6	4 11 0	7 8 0	107 15 6
							III, IV, V, VI, I	250	0 0 6	7 13 0	...	
	B	II	1,833	290	543	16 15 6	II	50	0 1 6	4 11 0	7 8 0	
							III, IV, V, VI, I	250	0 0 6	7 13 0	...	
	C	II	883	143	740	23 2 0	II	50	0 1 6	4 11 0	7 8 0	
							III, IV, V, VI, I	250	0 0 6	7 13 0	...	
1924–25	A	III	1,883	576	1,307	40 13 6	III	50	0 1 6	4 11 0	7 8 0	149 [illegible]4 0
							IV, V, VI, I, II	250	0 0 6	7 13 0	...	
	B	III	956	142	814	25 7 0	III	50	0 1 6	4 11 0	7 8 0	
							IV, V, VI, I, II	250	0 0 6	7 13 0	...	
	C	III	735	...	735	22 15 6	III	50	0 1 6	4 11 0	7 8 0	
							IV, V, VI, I, II	250	0 0 6	7 13 0	...	
1925–26	A	IV	1,944	...	1,944	60 12 0	IV	50	0 1 6	4 11 0	7 8 0	144 6 6
							V, VI, I, II, III	250	0 0 6	7 13 0	...	
	B	IV	986	696	290	9 1 0	IV	50	0 1 6	4 11 0	7 8 0	
							V, VI, I, II, III	250	0 0 6	7 13 0	...	
	C	IV	876	409	467	14 9 6	IV	50	0 1 6	4 11 0	7 8 0	
							V, VI, I, II, III	250	0 0 6	7 13 0	...	

Year. (1)	Felling series. (2)	First tending. Number of coupe. (3)	Area of coupe in acres. (4)	Area of enclosure included in coupe in acres. (5)	Area to be tended in acres, column 4—column 5. (6)	Cost at ½ anna per acre. (7)	Specially protected blocks average about 50 acres each. Number of coupe. (8)	Area. (9)	Cost. Per acre. (10)	Cost. Total. (10)	Cost of formation of permanent fire-line. (11)	Total cost. (12)
							CHENGAM WORKING CIRCLE—*cont.*					
						RS. A. P.			RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
1926–27	A	V	1,675	823	852	26 10 0	V	50	0 1 6	4 11 0	7 8 0	141 8 0
							VI, I, II, III, IV	250	0 0 6	7 13 0	...	
	B	V	1,065	447	618	19 5 0	V	50	0 1 6	4 11 0	7 8 0	
							VI, I, II, III IV	250	0 0 6	7 13 0	...	
	C	V	1,138	...	1,138	35 9 0	V	50	0 1 6	4 11 0	7 8 0	
							VI, I, II, III, IV	250	0 0 6	7 13 0	...	
1927–28	...	...	...	...	As in the year 1921–22		...	...	...	...	...	140 0 6
1928–29	...	...	...	...	As in the year 1922–23		...	...	...	...	...	136 13 6
1929–30	...	...	...	...	As in the year 1923–24		...	...	...	...	...	107 15 6
1930–31	...	...	...	...	As in the year 1924–25		...	...	...	...	...	149 4 0
1931–32	...	...	...	...	As in the year 1925–26		...	...	...	...	...	144 6 6
1932–33	...	...	...	...	As in the year 1926–27		...	...	...	...	...	141 8 0
											Total ...	2,249 10 6
											Average per annum ...	124 15 8
							TIRUPPATTUR WORKING CIRCLE.					
1916–17	A	I	1,974	...	1,974	61 11 0	I	50	0 1 6	4 11 0	7 8 0	219 0 0
	B	I	1,125	...	1,125	35 2 0	I	50	0 1 6	4 11 0	7 8 0	
	C	I	1,642	218	1,424	44 8 0	I	50	0 1 6	4 11 0	7 8 0	
	D	I	925	...	925	28 14 0	I	50	0 1 6	4 11 0	7 8 0	
1917–18	A	II	2,062	...	2,062	64 7 0	II	50	0 1 6	4 11 0	7 8 0	264 6 0
							I	50	0 0 6	1 9 0	...	
	B	II	1,433	...	1,433	44 12 6	II	50	0 1 6	4 11 0	7 8 0	
							I	50	0 0 6	1 9 0	...	
	C	II	1,556	116	1,440	45 0 0	II	50	0 1 6	4 11 0	7 8 0	
							I	50	0 0 6	1 9 0	...	
	D	II	1,166	...	1,166	55 3 0	II	50	0 1 6	4 11 0	7 8 0	
							I	50	0 0 6	1 9 0	...	
1918–19	A	III	980	...	980	30 10 0	III	50	0 1 6	4 11 0	7 8 0	209 7 0
							I, II	100	0 0 6	3 2 0	...	
	B	III	1,958	378	1,580	49 6 0	III	50	0 1 6	4 11 0	7 8 0	
							I, II	100	0 0 6	3 2 0	...	
	C	III	1,318	248	1,070	33 7 0	III	50	0 1 6	4 11 0	7 8 0	
							I, II	100	0 0 6	3 2 0	...	
	D	III	1,112	...	1,112	34 12 0	III	50	0 1 6	4 11 0	7 8 0	
							I, II	100	0 0 6	3 2 0	...	
1919–20	A	IV	1,129	...	1,129	35 4 6	IV	50	0 1 6	4 11 0	7 8 0	232 0 0
							I, II, III	150	0 0 6	4 11 0	...	
	B	IV	580	28	552	17 4 0	IV	50	0 1 6	4 11 0	7 8 0	
							I, II, III	150	0 0 6	4 11 0	...	
	C	IV	1,254	...	1,254	39 3 0	IV	50	0 1 6	4 11 0	7 8 0	
							I, II, III	150	0 0 6	4 11 0	...	
	D	IV	2,329	...	2,329	72 12 6	IV	50	0 1 6	4 11 0	7 8 0	
							I, II, III	150	0 0 6	4 11 0	...	
1920–21	A	V	494	...	494	15 7 0	V	50	0 1 6	4 11 0	7 8 0	170 6 6
							I, II, III, IV	200	0 0 6	6 4 0	...	
	B	V	812	216	596	18 10 0	V	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV	200	0 0 6	6 4 0	...	
	C	V	719	...	719	22 7 6	V	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV	200	0 0 6	6 4 0	...	
	D	V	1,284	...	1,284	40 2 0	V	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV	200	0 0 6	6 4 0	...	
1921–22	A	VI	386	...	386	12 1 0	VI	50	0 1 6	4 11 0	7 8 0	213 9 6
							I, II, III, IV, V	250	0 0 6	7 13 0	...	
	B	VI	797	25	772	24 2 0	VI	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV, V	250	0 0 6	7 13 0	...	
	C	VI	539	...	539	16 13 6	VI	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV, V	250	0 0 6	7 13 0	...	
	D	VI	2,578	...	2,578	80 9 0	VI	50	0 1 6	4 11 0	7 8 0	
							I, II, III, IV, V	250	0 0 6	7 13 0	...	

Year. (1)	Felling series. (2)	First tending. Number of coupe. (3)	Area of coupe in acres. (4)	Area of enclosure included in coupe in acres. (5)	Area to be tended in acres, column 4 — column 5. (6)	Cost at ½ anna per acre. (7)	Specially protected blocks average about 50 acres each. Number of coupe. (8)	Area. (9)	Cost. Per acre. (10)	Cost. Total. (10)	Cost of formation of permanent fire-line. (11)	Total cost. (12)
						RS. A. P.			RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
					TIRUPPATTUR WORKING CIRCLE—*cont.*							
	A	I	1,974	...	1,974	61 11 0	I II, III, IV, V, VI	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
	B	I	1,125	...	1,125	35 2 6	I II, III, IV, V, VI	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
1922–23	C	I	1,642	218	1,424	44 8 0	I II, III, IV, V, VI	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	250 4 0
	D	I	925	...	925	28 14 6	I II, III, IV, V, VI	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
	A	II	2,062	...	2,062	64 7 0	II III, IV, V, VI, I	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
	B	II	1,433	...	1,433	44 12 6	II III, IV, V, VI, I	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
1923–24	C	II	1,556	116	1,440	45 0 0	II III, IV, V, VI, I	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	289 6 6
	D	II	1,166	...	1,166	55 3 0	II III, IV, V, VI, I	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
	A	III	980	...	980	30 10 0	III IV, V, VI, I, II	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
	B	III	1,958	378	1,580	49 6 0	III IV, V, VI, I, II	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
1924–25	C	III	1,318	248	1,070	33 7 0	III IV, V, VI, I, II	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ..	228 3 0
	D	III	1,112	...	1,112	34 12 0	III IV, V, VI, I, II	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
	A	V	1,129	...	1,129	35 4 6	IV V, VI, I, II, III	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
	B	IV	580	28	552	17 4 0	IV V, VI, I, II, III	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
1925–26	C	IV	1,254	...	1,254	39 3 0	IV V, VI, I, II, III	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	244 8 0
	D	IV	2,329	...	2,329	72 12 6	IV V, VI, I, II, III	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
	A	V	494	...	494	15 7 0	V VI, I, II, III, IV	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
	B	V	812	216	596	18 10 0	V VI, I, II, III, IV	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
926–27	C	V	719	...	719	22 7 6	V VI, I, II, III, IV	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	176 10 6
	D	V	1,284	...	1,284	40 2 0	V VI, I, II, III, IV.	50 250	0 1 6 0 0 6	4 11 0 7 13 0	7 8 0 ...	
1927–28	...	...	...	...	As in the year 1921–22 ...			...	...	...	...	213 9 6
1928–29	...	...	...	...	As in the year 1922–23 ...			...	...	...	...	250 4 0
1929–30	...	...	...	...	As in the year 1923–24 ...			...	...	...	...	289 6 6
1930–31	...	...	...	...	As in the year 1924–25 ...			...	...	...	...	228 3 0
1931–32	...	...	...	...	As in the year 1925–26 ...			...	...	...	...	244 8 0
1932–33	...	...	...	...	As in the year 1926–27 ...			...	...	...	...	176 10 6
											Total ...	3,900 6 6
											Average per annum ...	216 11 0

Year. (1)	Felling series. (2)	First tending, Number of coupe. (3)	Area of coupe in acres. (4)	Area of enclosure included in coupe in acres. (5)	Area to be tended in acres, column 4—column 5. (6)	Cost at 1/4 anna per acre. (7)	Specially protected blocks average about 50 acres each. Number of coupe. (8)	Area. (9)	Cost. Per acre. (10)	Cost. Total. (10)	Cost of formation of permanent fire-line. (11)	Total cost. (12)
							THE YELAGIRIS WORKING CIRCLE.					
						RS. A. P.			RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
1916–17	A	I	535	122	413	12 14 6	I	50	0 1 6	4 11 0	7 8 0	56 6 6
	B	I	664	52	612	19 2 0	I	50	0 1 6	4 11 0	7 8 0	
1917–18	A	II	545	26	519	16 3 6	II	50	0 1 6	4 11 0	7 8 0	66 13 0
							I	50	0 0 6	1 9 0	...	
	B	II	739	...	739	23 1 6	II	50	0 1 6	4 11 0	7 8 0	
							I	50	0 0 6	1 9 0	...	
1918–19	A	III	458	20	438	13 11 0	III	50	0 1 6	4 11 0	7 8 0	59 4 6
							I, II	100	0 0 6	3 2 0	...	
	B	III	705	226	479	14 15 6	III	50	0 1 6	4 11 0	7 8 0	
							I, II	100	0 0 6	3 2 0	...	
1919–20	A	I	535	122	413	12 14 6	I	50	0 1 6	4 11 0	7 8 0	65 12 6
							I, II, III	150	0 0 6	4 11 0	...	
	B	I	664	52	612	19 2 0	I	50	0 1 6	4 11 0	7 8 0	
							I, II, III	150	0 0 6	4 11 0	...	
1920–21	A	II	545	26	519	16 3 6	II	50	0 1 6	4 11 0	7 8 0	76 3 0
							I, II, III, I	200	0 0 6	6 4 0	...	
	B	II	739	...	739	23 1 6	II	50	0 1 6	4 11 0	7 8 0	
							I, II, III, I	200	0 0 6	6 4 0	...	
1921–22	A	III	458	20	438	13 11 0	III	50	0 1 6	4 11 0	7 8 0	68 10 6
							I, II, III, I, II	250	0 0 6	7 13 0	...	
	B	III	705	226	479	14 15 6	III	50	0 1 6	4 11 0	7 8 0	
							I, II, III, I, II	250	0 0 6	7 13 0	...	
1922–23	A	I	535	122	413	12 14 6	I	50	0 1 6	4 11 0	7 8 0	72 0 6
							II, III, I, II, III	250	0 0 6	7 13 0	...	
	B	I	664	52	612	19 2 0	I	50	0 1 6	4 11 0	7 8 0	
							II, III, I, II, III	250	0 0 6	7 13 0	...	
1923–24	A	II	545	26	519	16 3 6	II	50	0 1 6	4 11 0	7 8 0	79 5 0
							III, I, II, III, I	250	0 0 6	7 13 0	...	
	B	II	739	...	739	23 1 6	II	50	0 1 6	4 11 0	7 8 0	
							III, I, II, III, I	250	0 0 6	7 13 0	...	
1924–25...	...	...	...	...	...	As in the year 1921–22		...	...	...	...	68 10 6
1925–26...	...	...	...	...	...	As in the year 1922–23		...	...	...	...	72 0 6
1926–27...	...	...	...	...	...	As in the year 1923–24		...	...	...	...	79 5 0
1927–28...	...	...	...	...	...	As in the year 1921–22		...	...	...	...	68 10 6
1928–29...	...	...	...	...	...	As in the year 1922–23		...	...	...	...	72 0 6
1929–30...	...	...	...	...	...	As in the year 1923–24		...	...	...	...	79 5 0
1930–31...	...	...	...	...	...	As in the year 1921–22		...	...	...	...	68 10 6
1931–32...	...	...	...	...	...	As in the year 1922–23		...	...	...	...	72 0 6
1932–33...	...	...	...	...	...	As in the year 1923–24		...	...	...	...	79 5 0
											Total ...	1,204 7 6
											Average per annum ...	66 14 8
											Average annual cost of tending for the whole district ...	**712 10 5**

38. *Regeneration.*—In the Javadis natural regeneration of sandal from seed is so good that the energies of the staff can be employed in encouraging and assisting nature better than in making plantations.

Sandal seedlings will die if not given plenty of light. Therefore immediately after a coupe is felled a cleaning should be made under all especially promising seed bearers and the soil scratched up round them; and all seedlings must be freed from any growth that is interfering with them; and thereafter the coupe must be gone over annually for the next three years, and the seedlings kept clear of overhead shade,—even the lateral shade must not be allowed to become too dense.

In conducting these cleaning operations the growth that is suppressing the sandal must not be uprooted, but must be cut back, or if advanced, girdled so that the light be not admitted too suddenly. If *small* blanks occur in these coupes seeds must be sown in them at the same time as the first cleaning is being made.

Fresh ripe seeds must be collected for this purpose, dried in the sun and sown four or five together in little patches of soil of about a foot square scratched up with a pointed stick, the seeds just covered with a sprinkling of soil, and then with a layer of dead leaves or grass, in order that the attention of squirrels and rats may not be attracted by the newly worked soil. Each of these patches must be within half a foot of some such underwood species as is known to serve as a host to sandal (*vide* list in Appendix III) and should also be in the neighbourhood of a healthy fairly young specimen of one of the overwood hosts (*vide* list in Appendix III). This method of regeneration has been adopted with much success for some years past in Coorg. No attempt, however, should be made at present to plant up *large* blanks that contain no sandal growth.

The Deputy Rangers in charge of felling series must, in person, supervise this work as well as the tending of the older crop referred to in paragraph 37, as on the proper conduct of these operations depends the whole future of the forest.

The cost of the cultural operations will be one anna per acre in the first year and about 4 pies per acre in each of the next two years. These figures as well as those given for tending in the last paragraph have been obtained by actual experiment over several hundreds of acres.

In addition to these measures I would recommend that the "Taungya" system which has been so successfully applied to the regeneration of teak in Burma be tried experimentally with the sandal here. For this purpose small areas may be granted to selected Malayalis for "Ponnakad" cultivation, free of all rent, on condition that after a given number of years they fence them and hand them back to the Forest Department with a certain number of sandal trees and suitable host trees growing on them. This seems to be an eminently suitable system as the Malayalis prefer "Ponnakad" to any other form of cultivation and as sandal thrives best, and is found growing most thickly on areas that have been under cultivation in former years. This is probably due partly to the light that is let in and partly to the working up of the soil and to the congregation of birds,—which carry the sandal seed,—in these open cultivated spaces. Whatever the reason be, the fact that such areas usually contain a larger number of trees than the surrounding jungle cannot be disputed, and therefore to give this system a trial can do no harm, and may do infinite good.

It may be tried first in the Yelagiris Working Circle which is easy of access and close at hand, and therefore is well adapted for such experiments.

In portions of enclosures and unreserves that are included in the coupes no cultural operations need be undertaken. A tabular statement showing year of working, area, and cost of the operations is given below.

Year of working. (1)	Felling series. (2)	Coupe number. (3)	Area of the coupe. (4)	Area of enclosure included in the coupe. (5)	Area to be regenerated (column 4 *minus* column 5). (6)	Cost. Rate per acre. (7)	Cost. Annual total for the felling series (column 6 × column 7). (8)	Cost. Annual total for the working circle. (9)
						RS. A. P.	RS. A. P.	RS. A. P.
				SANTHAVASAL WORKING CIRCLE.				
1915-16	A	I	1,627	1,016	611	0 1 0	38 3 0	183 4 0
	B	I	1,597	...	1,597	0 1 0	99 13 0	
	C	I	882	158	724	0 1 0	45 4 0	
1916-17	A	II	1,705	1,264	441	0 1 0	27 9 0	241 4 4
		I	..	...	611	0 0 4	12 11 8	
	B	II	1,505	220	1,285	0 1 0	80 5 0	
		I	..	...	1,597	0 0 4	33 4 4	
	C	II	837	...	837	0 1 0	52 5 0	
		I	..	...	724	0 0 4	15 1 4	
1917-18	A	III	1,219	581	638	0 1 0	39 14 0	267 9 8
		I, II	...	...	1,052	0 0 4	21 14 8	
	B	III	1,770	220	1,550	0 1 0	96 14 0	
		I, II	...	...	2,882	0 0 4	60 0 8	
	C	III	1,585	1,323	262	0 1 0	16 6 0	
		I, II	..	..	1,561	0 0 4	32 8 4	
1918-19	A	IV	1,411	847	564	0 1 0	35 4 0	198 8 0
		II, III	...	...	1,079	0 0 4	22 7 8	
	B	IV	848	262	586	0 1 0	36 10 0	
		II, III	...	...	2,835	0 0 4	59 1 0	
	C	IV	2,284	1,929	355	0 1 0	22 3 0	
		II, III	..	...	1,099	0 0 4	22 14 4	
1919-20	A	V	904	...	904	0 1 0	56 8 0	248 13 4
		III, IV	...	...	1,202	0 0 4	25 0 8	
	B	V	866	...	866	0 1 0	54 2 0	
		III, IV	...	..	2,136	0 0 4	44 8 0	
	C	V	1,947	1,054	893	0 1 0	55 13 0	
		III, IV	...	...	617	0 0 4	12 13 8	
1920-21	A	VI	1,129	134	995	0 1 0	62 3 0	254 8 4
		IV, V	.	...	1,468	0 0 4	30 9 4	
	B	VI	1,068	45	1,023	0 1 0	63 15 0	
		IV, V	...	...	1,452	0 0 4	30 4 0	
	C	VI	1,303	638	665	0 1 0	41 9 0	
		IV, V	...	...	1,248	0 0 4	26 0 0	
1921-22	A	I	...	...	611	0 1 0	38 3 0	294 10 0
		V, VI	...	...	1,899	0 0 4	39 0 0	
	B	I	..	...	1,597	0 1 0	99 13 0	
		V, VI	...	...	1,889	0 0 4	39 5 8	
	C	I	.	...	724	0 1 0	45 4 0	
		V, VI	...	...	1,558	0 0 4	32 7 4	
1922-23	A	II		..	441	0 1 0	37 9 0	286 5 4
		VI, I	...	...	1,566	0 0 4	32 10 0	
	B	II		...	1,285	0 1 0	80 5 0	
		VI, I	...		2,620	0 0 4	54 9 4	
	C	II	...	...	837	0 1 0	52 5 0	
		VI, I	...	...	1,389	0 0 4	28 15 0	
1923-24	A	III						
		I, II						
	B	III	As in 1917-18 ...	...	...	...	...	267 9 8
		I, II						
	C	III						
		I, II						
1924-25	...	...	As in 1918-19 ...	...	...	...	...	198 8 0
1925-26	...	...	As in 1919-20 ...	...	...	...	...	248 13 4
1926-27	...	...	As in 1920-21 ...	...	..	...	...	254 8 4
1927-28	..	...	As in 1921-22 ...	...	...	...	...	294 10 0
1928-29 ...	...	...	As in 1922-23 ...	...	...	...	...	286 5 4
1929-30	...	...	As in 1917-18 ...	...	...	...	...	267 9 8
1930-31	...	...	As in 1918-19 ...	...	...	...	...	198 8 0
1931-32	...	...	As in 1919-20 ...	...	...	...	...	248 13 4
1932-33	...	...	As in 1920-21 ...	...	...	...	...	254 8 4
		Total cost for Santhavasal Working Circle for the felling period ...						4,494 13 0
					Average cost per annum ...			249 10 10

Year of working. (1)	Felling series. (2)	Coupe number. (3)	Area of the coupe. (4)	Area of enclosure included in the coupe. (5)	Area to be regenerated. (column 4 *minus* column 5). (6)	Cost. Rate per acre. (7)	Cost. Annual total for the felling series (column 6 × column 7). (8)	Cost. Annual total for the working circle. (9)
POLUR WORKING CIRCLE.								
						RS. A. P.	RS. A. P.	RS. A. P.
1915-16	A	I	1,668	74	1,594	0 1 0	99 10 0	320 8 0
	B	I	1,861	58	1,803	0 1 0	112 11 0	
	C	I	3,066	1,325	1,731	0 1 0	108 3 0	
1916-17	A	II	984	...	984	0 1 0	59 4 0	350 11 4
		I	...	...	1,594	0 0 4	33 3 4	
	B	II	1,947	143	1,804	0 1 0	112 12 0	
		I	...	...	1,803	0 0 4	37 9 0	
	C	II	2,689	1,536	1,153	0 1 0	71 14 0	
		I	...	...	1,731	0 0 4	36 1 0	
1917-18	A	III	726	25	701	0 1 0	43 13 0	349 7 0
		I, II	...	...	2,542	0 0 4	52 15 4	
	B	III	1,858	189	1,669	0 1 0	104 5 0	
		I, II	...	...	3,607	0 0 4	75 2 4	
	C	III	1,436	1,226	210	0 1 0	13 2 0	
		I, II	...	...	2,884	0 0 4	60 1 4	
1918-19	A	IV	749	277	472	0 1 0	29 8 0	343 7 8
		II, III	...	...	1,649	0 0 4	34 5 8	
	B	IV	2,481	28	2,453	0 1 0	153 5 0	
		II, III	...	...	3,473	0 0 4	72 5 8	
	C	IV	669	260	409	0 1 0	25 9 0	
		II, III	...	...	1,363	0 0 4	28 6 4	
1919-20	A	V	2,208	500	1,708	0 1 0	106 12 0	421 15 4
		III, IV	...	...	1,173	0 0 4	24 7 0	
	B	V	2,413	81	2,332	0 1 0	145 12 0	
		III, IV	...	...	4,122	0 0 4	85 14 0	
	C	V	1,828	1,088	740	0 1 0	46 4 0	
		III, IV	...	...	619	0 0 4	12 14 4	
1920-21	A	VI	1,870	1,296	574	0 1 0	35 14 0	333 15 8
		IV, V	...	...	2,180	0 0 4	45 6 8	
	B	VI	1,392	67	1,325	0 1 0	82 13 0	
		IV, V	...	...	4,785	0 0 4	99 11 0	
	C	VI	1,161	421	740	0 1 0	46 4 0	
		IV, V	...	...	1,149	0 0 4	23 15 0	
1921-22	A	I	...	...	1,594	0 1 0	99 10 0	475 1 0
		V, VI	...	...	2,282	0 0 4	47 8 8	
	B	I	...	...	1,803	0 1 0	112 11 0	
		V, VI	...	...	3,657	0 0 4	76 3 0	
	C	I	...	...	1,731	0 1 0	108 3 0	
		V, VI	...	...	1,480	0 0 4	30 13 4	
1922-23	A	II	...	...	948	0 1 0	59 4 0	405 13 0
		VI, I	...	...	2,168	0 0 4	45 2 8	
	B	II	...	...	1,804	0 1 0	112 12 0	
		VI, I	...	...	3,128	0 0 4	65 2 8	
	C	II	...	...	1,153	0 1 0	72 1 0	
		VI, I	...	...	2,471	0 0 4	51 7 8	
1923-24	A	III	As in 1917-18 ...	...	...	..	...	349 7 0
		I, II						
	B	III						
		I, II						
	C	III						
		I, II						
1924-25	...	...	As in 1918-19 ...	...	...	...	...	343 7 8
1925-26	...	...	As in 1919-20 ...	...	...	...	...	421 15 4
1926-27	...	...	As in 1920-21 ...	...	...	...	...	333 15 8
1927-28	...	..	As in 1921-22 ...	...	...	...	...	475 1 0
1928-29	...	...	As in 1922-23 ...	...	...	...	...	405 13 0
1929-30	...	...	As in 1917-18 ...	...	...	...	...	349 7 0
1930-31	...	...	As in 1918-19 ...	...	...	...	...	343 7 8
1931-32	...	...	As in 1919-20 ...	...	...	...	...	421 15 4
1932-33	...	...	As in 1920-21 ...	...	...	...	...	333 15 8
			Total cost for Polur Working Circle for the felling period ...					6,379 8 4
			Average cost per annum ...					354 6 8

Year of working. (1)	Felling series. (2)	Coupe number. (3)	Area of the coupe. (4)	Area of enclosure included in the coupe. (5)	Area to be regenerated (column 4 *minus* column 5). (6)	Cost. Rate per acre. (7)	Cost. Annual total for the felling series (column 6 × column 7). (8)	Cost. Annual total for the working circle. (9)
						RS. A. P.	RS. A. P.	RS. A. P.
CHENGAM WORKING CIRCLE.								
1915-16	A	I	1,784	870	914	0 1 0	57 2 0	
	B	I	1,129	319	810	0 1 0	50 10 0	153 11 0
	C	I	1,129	394	735	0 1 0	45 15 0	
1916-17	A	II	1,811	1,559	252	0 1 0	15 12 0	
		I	...	...	914	0 0 4	19 0 8	
	B	II	833	290	543	0 1 0	33 15 0	
		I	...	...	810	0 0 4	16 14 0	147 2 8
	C	II	883	143	740	0 1 0	46 4 0	
		I	...	...	735	0 0 4	15 5 0	
1917-18	A	III	1,883	576	1,307	0 1 0	81 11 0	
		I, II	...	...	1,166	0 0 4	24 4 8	
	B	III	956	142	814	0 1 0	50 14 0	
		I, II	...	...	1,353	0 0 4	28 3 0	261 11 4
	C	III	735	...	735	0 1 0	45 15 0	
		I, II	...	...	1,475	0 0 4	30 11 8	
1918-19	A	IV	1,944	...	1,944	0 1 0	121 8 0	
		II, III	...	...	1,559	0 0 4	32 7 8	
	B	IV	986	696	290	0 1 0	18 2 0	
		II, III	...	...	1,357	0 0 4	28 4 4	260 4 8
	C	IV	876	409	467	0 1 0	29 3 0	
		II, III	...	...	1,475	0 0 4	30 11 8	
1919-20	A	V	1,675	823	852	0 1 0	53 4 0	
		III, IV	...	...	3,251	0 0 4	67 11 8	
	B	V	1,065	447	618	0 1 0	38 10 0	
		III, IV	...	...	1,104	0 0 4	23 0 0	278 12 4
	C	V	1,138	...	1,138	0 1 0	71 2 0	
		III, IV	...	...	1,202	0 0 4	25 0 8	
1920-21	A	VI	2,368	1,585	783	0 1 0	48 15 0	
		IV, V	...	...	2,796	0 0 4	58 4 0	
	B	VI	891	190	701	0 1 0	43 13 0	
		IV, V	...	...	908	0 0 4	18 14 8	270 10 8
	C	VI	1,272	195	1,077	0 1 0	67 5 0	
		IV, V	...	...	1,605	0 0 4	33 7 0	
1921-22	A	I	...	...	914	0 1 0	57 2 0	
		V, VI	...	...	1,635	0 0 4	34 1 0	
	B	I	...	...	810	0 1 0	50 10 0	
		V, VI	...	...	1,319	0 0 4	27 7 8	261 6 0
	C	I	...	...	735	0 1 0	45 15 0	
		V, VI	...	...	2,215	0 0 4	46 2 4	
1922-23	A	II	...	...	252	0 1 0	15 12 0	
		VI, I	...	...	1,697	0 0 4	35 5 8	
	B	II	...	...	543	0 1 0	33 15 0	
		VI, I	...	...	1,511	0 0 4	31 7 8	200 8 4
	C	II	...	...	740	0 1 0	46 4 0	
		VI, I	...	...	1,812	0 0 4	37 12 0	
1923-24	A, B, C	...	...	As in 1917-18 ...	...	...	...	261 11 4
1924-25	...	...	...	As in 1918-19 ...	...	...	...	260 4 8
1925-26	...	...	...	As in 1919-20 ...	...	...	...	278 12 4
1926-27	...	...	...	As in 1920-21 ...	...	...	...	270 10 8
1927-28	...	...	...	As in 1921-22 ...	...	...	...	261 6 0
1928-29	...	...	...	As in 1922-23 ...	...	...	...	200 8 4
1929-30	...	...	...	As in 1917-18 ...	...	...	...	261 11 4
1930-31	...	...	...	As in 1918-19 ...	...	...	...	260 4 8
1931-32	...	...	...	As in 1919-20 ...	...	...	...	278 12 4
1932-33	...	...	...	As in 1920-21 ...	...	...	...	270 10 8
Total cost for Chengam Working Circle for the felling period ...								4,438 15 4
Average cost per annum ...								246 9 9

Year of working.	Felling series.	Coupe number	Area of the coupe.	Area of enclosure included in the coupe.	Area to be regenerated (column 4 *minus* column 5).	Cost. Rate per acre.	Cost. Annual total for the felling series (column 6 × column 7).	Annual total for the working circle.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
						RS. A. P.	RS. A. P.	RS. A. P.
TIRUPPATTUR WORKING CIRCLE.								
1915-16	A	I	1,974	..	1,974	0 1 0	123 6 0	
	B	I	1,125	...	1,125	0 1 0	70 5 0	
	C	I	1,642	218	1,424	0 1 0	89 0 0	340 8 0
	D	I	925	...	925	0 1 0	57 13 0	
1916-17	A	II	2,062	...	2,062	0 1 0	128 14 0	
		I		...	1 974	0 0 4	30 13 8	
	B	II	1,433	...	1.433	0 1 0	89 9 0	
		I	...	..	1,125	0 0 4	23 7 0	
	C	II	1.556	116	1,440	0 1 0	90 0 0	484 8 8
		I	...	...	1,424	0 0 4	29 10 8	
	D	II	1,166	...	1,166	0 1 0	72 14 0	
		I	.	...	925	0 0 4	19 4 4	
1917-18	A	III	980	...	980	0 1 0	61 4 0	
		I, II	...	..	4,036	0 0 4	63 1 0	
	B	III	1,958	378	1,580	0 1 0	98 12 0	
		I, II	..	..	2,558	0 0 4	53 4 8	
	C	III	1,318	248	1,070	0 1 0	66 14 0	515 12 4
		I, II		..	2,864	0 0 4	59 10 8	
	D	III	1,112	...	1,112	0 1 0	69 5 0	
		I, II	..	...	2,091	0 0 4	43 9 0	
1918-19	A	IV	1,129	...	1,129	0 1 0	70 9 0	
		II, III	...	...	3,042	0 0 4	63 6 0	
	B	IV	580	28	552	0 1 0	34 8 0	
		II, III	.	...	3.013	0 0 4	62 12 4	
	C	IV	1,254	...	1,254	0 1 0	78 6 0	554 14 4
		II, III	...	...	2,510	0 0 4	52 4 8	
	D	IV	2,329	...	2,329	0 1 0	145 9 0	
		II, III	...	...	2,278	0 0 4	47 7 4	
1919-20	A	V	494	...	494	0 1 0	30 14 0	
		III, IV	...	..	2,109	0 0 4	43 15 0	
	B	V	812	216	596	0 1 0	35 6 0	
		III, IV	...	...	2,132	0 0 4	44 6 8	
	C	V	719	...	719	0 1 0	44 15 0	399 14 4
		III, IV	...	...	2,324	0 0 4	48 6 8	
	D	V	1,284	...	1,284	0 1 0	80 4 0	
		III, IV	...	...	3,441	0 0 4	71 11 0	
1920-21	A	VI	386	...	386	0 1 0	24 2 0	
		IV, V	...	...	1,623	0 0 4	33 13 0	
	B	VI	797	25	772	0 1 0	48 4 0	
		IV, V	..	...	1,148	0 0 4	23 14 8	
	C	VI	539	...	539	0 1 0	33 11 0	441 14 8
		IV, V	..	...	1,973	0 0 4	41 11 8	
	D	VI	2,578	...	2,578	0 1 0	161 2 0	
		IV, V	...	...	3,613	0 0 4	75 4 4	
1921-22	A	I	...	...	1,974	0 1 0	123 6 0	
		V, VI	...	...	880	0 0 4	18 5 4	
	B	I	...	...	1,125	0 1 0	70 5 0	
		V, VI	...	...	1,368	0 0 4	28 8 0	
	C	I	...	...	1,424	0 1 0	89 0 0	494 0 0
		V, VI	...	...	1,258	0 0 4	26 3 4	
	D	I	...	...	925	0 1 0	57 13 0	
		V, VI	...	...	3,862	0 0 4	80 7 4	
1922-23	A	II	...	...	2,062	0 1 0	128 14 0	
		VI, I	...	...	2,360	0 0 4	49 2 8	
	B	II	...	...	1,433	0 1 0	89 9 0	
		VI, I	...	...	1,897	0 0 4	39 8 4	
	C	II	...		1,440	0 1 0	90 0 0	583 14 0
		VI, I	...		1,963	0 0 4	40 14 4	
	D	II	...		1,166	0 1 0	72 14 0	
	...	VI, I	...		3,503	0 0 4	72 15 8	
1923-24	...	...	...	As in 1917-18	...	... ...	...	515 12 4
1924-25	...	..	...	As in 1918-19	...	... ..	...	554 14 4
1925-26	..	...	...	As in 1919-20	...	... ..	...	399 14 4
1926-27	...	...	...	As in 1920-21	...	... ..	...	441 14 8
1927-28	...	..	...	As in 1921-22	...	... ...	...	494 0 0
1928-29	...	...	...	As in 1922-23	...	... ...	...	583 14 0
1929-30	...	...	...	As in 1917-18	...	... ...	...	515 12 4
1930-31	...	...	...	As in 1918-19	...	... ...	...	554 14 4
1931-32	...	...	...	As in 1919-20	...	... ..	..	399 14 4
1932-33	...	...	...	As in 1920-21	...	... ...	...	441 14 8
			Total cost for the Tiruppattur Working Circle for the felling period					8,718 5 6
					Average cost per annum ...			484 5 6

Year of working. (1)	Felling series. (2)	Coupe number. (3)	Area of the coupe. (4)	Area of enclosure included in the coupe. (5)	Area to be regenerated (column 4 *minus* column 5). (6)	Cost. Rate per acre. (7)	Cost. Annual total for the felling series (column 6 × column 7). (8)	Cost. Annual total for the working circle. (9)
THE YELAGIRIS WORKING CIRCLE.								
						RS. A. P.	RS. A. P.	RS. A. P.
1915-16	A	I	535	122	413	0 1 0	25 13 0	64 1 0
	B	I	664	52	612	0 1 0	38 4 0	
1916-17	A	II	545	26	519	0 1 0	32 7 0	
		I	...	...	413	0 0 4	6 8 4	
	B	II	739		739	0 1 0	46 3 0	97 14 4
		I	...	...	612	0 0 4	12 12 0	
1917-18	A	III	458	20	438	0 1 0	27 6 0	
		I, II	...	...	932	0 0 4	19 6 8	
	B	III	705	226	479	0 1 0	29 15 0	104 14 0
		I, II	...	...	1,351	0 0 4	28 2 4	
1918-19	A	I	...	...	413	0 1 0	25 13 0	
		II, III	...	...	957	0 0 4	19 15 0	
	B	I	...	...	612	0 1 0	38 4 0	109 6 0
		II, III	...	...	1,218	0 0 4	25 6 0	
1919-20	A	II	...	...	519	0 1 0	32 7 0	
		III, I	...	...	851	0 0 4	17 11 8	
	B	II	...	...	739	0 1 0	46 3 0	119 1 4
		III, I	...	...	1,091	0 0 4	22 11 8	
1920-21	A	III						
		I, II						
	B	III	...	As in 1917-18	...	... ...	...	104 14 0
		I, II						
1921-22	...	...	...	As in 1918-19	...	... ...	..	109 6 0
1922-23	...	...	...	As in 1919-20	...	... ...	...	119 1 4
1923-24	...	...	...	As in 1917-18	...	... ...	...	104 14 0
1924-25	...	...	...	As in 1918-19	...	... ...	...	109 6 0
1925-26	...	...	...	As in 1919-20	...	... ...	...	119 1 4
1926-27	...	...	...	As in 1917-18	...	... ...	...	104 14 0
1927-28	...	...	...	As in 1918-19	...	... ...	...	109 6 0
1928-29	...	...	...	As in 1919-20	..	... ...	...	119 1 4
1929-30	...	...	...	As in 1917-18	...	... ...	...	104 14 0
1930-31	...	...	...	As in 1918-19	...	... ...	...	109 6 0
1931-32	...	...	...	As in 1919-20	...	... ...	..	119 1 4
1932-33	...	...	...	As in 1917-18	...	... ...	...	104 14 0
Total cost for the Yelagiris Working-Circle for the felling period ...								1,933 8 0
Average cost for one year ...								107 6 8
Average annual cost of total cultural operations ...								**1,442 7 5**

39. *Grazing.*—The grazing question in these forests is of great importance. The reserves have not yet, I believe, been classified in accordance with the recommendations contained in the Forest Committee's Report, but they will, I have no doubt, be placed in class II as being timber forests of great value. Nevertheless, a certain amount of grazing must necessarily be allowed. This should however be in the nature of a concession rather than in any way a right. I would suggest that for cattle and sheep a concession of *free grazing* should be granted throughout the Javadis to all genuine resident Malayalis and to them only. The number of head admissible should be limited to those already present in the hills, and no permits for other cattle should be issued at all. A cattle census must be held to determine what this number is at a very early date. This concession should be granted subject to certain conditions, standardized for the whole district, the principal objects of which should be—

(1) preservation of sandalwood from theft and hacking,
(2) fire protection of sandal areas, and
(3) elimination of the goat.

Very limited grazing will help rather than hinder the growth of sandal as it will keep down too thick a growth of grass over seedlings and will help to keep the forest open. The special regeneration areas however, referred to in paragraph 38 above, must be strictly closed to grazing of any sort. The closure can only be effective if stone walls or fences as described above are erected. In these cases, the areas being small, the sandalwood staff is responsible for assisting the young growth to hold its own against grass and other noxious growth.

Goats however must be rigidly excluded from all sandal areas. They single out sandal trees wherever they can get at them and eat their foliage in preference to that of any other tree; and the goat-herds fell sandal saplings, young poles, and even trees, containing heartwood, in large numbers, to feed their goats on. This goes on chiefly in the unreserves, but also in the Reserved Forest itself and it seems to be a matter of the very greatest difficulty in these inaccessible hills to put a stop to this wanton destruction. It would appear that the only way effectually to prevent it is to forbid the keeping of goats on these hills altogether. For this purpose probably special legislation would be necessary, but in my opinion it is called for. This need not be a hardship to the Malayalis as sheep may be kept instead and grazed free on concession.

40. *Improvements common to the whole-area Communications.*—For the successful protection of these forests it is necessary that they be opened up and made easy of access. For this purpose roads and bridle-paths must be constructed. These will eventually pay for the cost of their construction by the consequent decrease in cost of extracting the sandalwood which will result from carting the produce as opposed to carrying it in head-loads over long distances.

The roads and bridle paths now in existence and under construction are:—

Polur and Santhavasal Ranges—

(1) Thaniar to Patrakad (a good ghat road).
(2) Patrakad to Komuttiyore (under construction).
(3) Komuttiyore to Alangayam (a cart-track; it runs partly through Tiruppattur range).
(4) Mandaparai to Melarasanpet (cart-track).

Tiruppattur Range—

(1) Kambugudi to Andiappanur (a fair ghat road),

Chengam Range—

(1) Melpat to Paramanandal (a bridle path).

These roads and bridle-paths are shown by blue and red lines respectively on the road map (*vide* map No. 2, Appendix No. I).

The construction of the following roads and bridle-paths is now proposed; they are shown similarly by blue and red broken lines on the same map. They have not been traced on the ground and their alignment is therefore shown on the map only approximately.

Roads—(1) *Nadanur to Amerdi.*—This is of very great importance for extraction of sandal, the trace will not be a difficult one and the road will tap the whole of Puttur and parts of Tellai, Malayalam and Patrakad reserves. This road will be about nine miles long and should cost Rs. 1,000 per mile for the plains portion and the portion on the plateau; for the three miles of ghat at least Rs. 2,000 a mile will be required.

(2) *Nadanur to Patrakad.*—This is also an easy trace, and is of importance for opening up the forest and for protective purposes, as well as for extraction of sandal. The length of this road will be about eight miles and the cost should average not more than Rs. 1,000 per mile.

(3) *Along the centre of the plateau in Tiruppattur Range.*—This road, the only one prescribed for this range should run from Malayandipatti in the extreme south of the plateau to Kambugudi, *viâ* Puliyore, Pudur and Kotanur, and should join the Kambugudi ghat road at the twelfth mile. Thus the whole plateau will be tapped and the extraction of sandalwood greatly cheapened. This road is of very great importance. Its length will be approximately sixteen miles and its cost per mile about Rs. 750.

(4) *Along the centre of the Tenmalai plateau.*—This road should run from Melpattu, *viâ* Puliyanur and Kuttathur to meet the Komuttiyore-Alangayam cart-road at about the fourth mile from Komuttiyore. The whole sandal area can thus be easily tapped; short feeder roads may be made to east and west of the main road when required.

N.B.—The sandalwood from Chengam Range is in future probably to be carried to Jalarpet and sold with that from Tiruppattur Range, instead of, as at present, being sold by itself at Tiruvannamalai.

Approximate length of this road will be 12 miles and cost Rs. 1,000 per mile.

(5) *Melpattu to Paramanandal.*—The present bridle-path should be converted into a road. This is not of so such importance as the other roads prescribed. Its length is 7 miles and approximate cost of conversion will be not less than Rs. 1,500 per mile.

Bridle-paths, 6 feet wide—

From—

(1) Vedatope to Mulacad, 5½ miles long.
(2) Tongamalai to Nadanur, 4¾ miles long.
(3) Mandaparai to Nadanur, 5¼ miles long.
(4) From Puliyankuppam to meet the Nadanur-Amerdi road, 1 mile.
(5) Puliyankuppam to Shenbagatope, 2¼ miles long.
(6) Pudur down to Matrapalli, about 9 miles.
(7) Malayandipatti to meet the Singarapet cart-track at Puliyanoor, about 3½ miles.

Average cost about Rs. 250 per mile.

These bridle-paths are all of importance both to facilitate extraction of the produce and also to open up the forest and so improve protection. They should all be traced so as to be subsequently convertible into cart roads.

The total cost of this scheme of roads and bridle-paths will thus be about Rs. 62,300. This sum may, however, be spread over some five or six years, and will be amply repaid by the opening up of these, at present rather inaccessible, forests and resultant better protection; and by the much cheaper cost of extraction of sandalwood, consequent on carting as opposed to carriage by head-loads, as also of bamboos and other forest produce.

Accommodation.—To facilitate and encourage inspection of the forests it is highly important that there should be forest rest-houses and subordinates' quarters throughout the hills at frequent intervals. Bungalows already exist at Mandaparai and Nadanur in Santhavasal Range, Patrakad and Komuttiyore in Polur Range, Kambugudi and Kotur in Tiruppattur Range, and Melpattu in Chengam Range.

Those at Mandaparai and Komuttiyore require rebuilding as they are very old mud and thatch constructions scarcely fit for occupation, and these are two very important sandalwood centres. That at Patrakad can in future be utilized

as subordinates' quarters as a new bungalow is now in process of construction at a short distance from the old one. New well-built rest-houses are also needed in the neighbourhood of Thongumalai in the Santhavasal Range; near Kuttathur in the Tenmalai forests of Chengam Range; and near Malayandipatti and Puliyore in Tiruppattūr Range. All these bungalows should be stone in mud built on the standard plan, and should have godowns and stables attached. The estimated cost of similar buildings at Patrakad which are now in process of construction is Rs. 4,400.

Subordinates' quarters now exist at Komuttiyore in Polur Range and Kambugudi and Kotur in Tiruppattur Range. The old rest-house at Patrakad may, as stated above, be utilised for subordinates as soon as the new rest-house is completed. New buildings consisting of four rooms with kitchens behind and a verandah running the length of the building in front should be constructed at Thongumalai and Nadanur in Santhavasal Range, Bargur in Polur Range, Melpattu and Kuttathur in Chengam Range and Pudur and Malayandipatti in Tiruppattūr Range.

These buildings should be constructed on the same plan as that at Komuttiyore which cost Rs. 1,340. The erection of good watertight buildings for the subordinates is of primary importance as living in the hills is at the best of times unhealthy and uncongenial, and every encouragement should therefore be given to the men who are sent to these places, and on whose good work so largely depends the future of the sandalwood in these forests.

The total cost of the buildings prescribed in this plan will be Rs. 35,780 which expenditure may be spread over some five or six years. The position of the existing and proposed bungalows and subordinates' quarters are shewn on Map No. 2. (*Vide* Appendix No. I.)

Fire protection.— The fire lines that are maintained at present, above ghats, are shown in the statement that follows as well as on Map No. 2. (*Vide* Appendix No. I.)

Range.	Fire line. From	Fire line. To	Length.	Cost of upkeep per mile.	Total cost.	Remarks.
			MILES.	RS. A. P.	RS. A. P.	
Santhavasal.	1. Kudikam in Puthur Reserved forest.	Valaiparai in Malayalam Reserved forest.	19		162 0 0	
	2. Trijunction point of Mulacad, Patrakad and Malayalam Reserved forests.	Turinjikuppam in Santhavasal Reserved forest.	8			
Polur.	Kudikam in Puthur Reserved forest.	Trijunction point of Mulacad, Patrakad and Malayalam Reserved forests.	24		144 0 0	
Chengam.	Punaikattipallam in Tenmalai Reserved forest.	South-east corner of Pelamarathur Reserved forest.	31	6 0 0 (approximate.)	201 0 0	
	A portion of the bridle-path from Paramanandal to Melpattu.		2½			
Tiruppattur.	In Andiappanur Reserved forest		5		88 8 0	
	In Mambakkam Reserved forest		3			
	In Singarapet Extension Reserved forest ...		4			
	In Singarapet Reserved forest		2¾			
			99¼	6 0 0	595 8 0	

With the exception of those round the specially protected areas referred to in paragraph 37 above (the cost of which is included under "tending"), it is not proposed to prescribe the formation of any *new* fire lines. Such undoubtedly help to prevent fires from spreading, but where, as is the case in these hills, most of the fires are due to incendiarism other additional methods must be employed for their prevention. It is therefore proposed that the villages in each reserve should be made responsible for the protection of that reserve from fire, being given *substantial* rewards at the end of the fire season if there have been

no fires at all; smaller rewards if, should a fire have broken out, they have circumscribed its limits to a small area; and no reward at all if any large area has been burnt. In the latter case they may also be further punished in any aggravated case by having their concessions of free grazing diminished or altogether withdrawn for a year.

Eradication of Lantana.—Lantana exists in the hills in very small quantities in some of the unreserves and patta lands of Chengam Range. It must immediately be pulled up by the roots and burnt. This operation will at the present juncture cost less than a hundred rupees, but if long delayed, it will not be possible to undertake it without an expenditure of many thousands. A careful watch must be kept throughout the Javadis to see that it is not anywhere at any time introduced. If it now exists in any other part of the hills the fact must be reported by the subordinates and steps immediately taken to have it destroyed.

CHAPTER V.

MISCELLANEOUS.

41. *Changes proposed in the Forest Staff.*—The successful working of this plan entirely depends on the adequacy of the staff employed. The minimum establishment that can cope with the work,—which is arduous, as well as being of a highly specialized nature,—is one Deputy Ranger with a trained Forest Guard under him in *each* Felling Series throughout the Javadis. In the Yelagiris which forms a Working Circle by itself consisting of two Felling Series, one Deputy Ranger with two guards working under him will be sufficient. The Deputy Ranger's work will consist in personally selecting and marking for felling the trees in the current year's coupes, and afterwards in supervising the girdling and uprooting of these trees; and then in supervising the extraction of the trees that were girdled in the coupe of the last year but one; and finally in tending the crop and assisting the natural regeneration in the coupes of the three previous years.

As each coupe is of from one to two thousand acres in extent,—those in Veerappanur Felling Series being even larger, the Deputy Rangers will have as much as they can do to get through the work properly.

Below is appended a statement showing the cost of the prescribed establishment.

Working circles.	Felling series.	Deputy Rangers.	Forest Guards.	Annual cost of Deputy Rangers at Rs. 43 per mensem each.	Annual cost of Forest Guards at Rs. 12 per mensem each.	Total annual cost.
				RS.	RS.	RS.
Tirupattur ...	4	4	4	2,064	576	2,640
Yelagiris	2	1	2	516	288	804
Chengam	3	3	3	1,548	432	1,980
Polur	3	3	3	1,548	432	1,980
Santhavasal	3	3	3	1,548	432	1,980
Total ...	15	14	15	7,224	2,160	9,384

N.B.—The calculation is made taking the average pay of a Deputy Ranger *plus* Rs. 8, fixed Travelling Allowance.

The great and increasing value of the produce fully justifies financially this small increase in annual expenditure.

42. *Financial results of proposed working.*—Owing to the many difficulties referred to above that stand in the way of foretelling the future yield of the forest no accurate forecast of financial results can be made. *If however the yield as estimated in paragraph 36 above is assumed to be correct, calculations may be made on that basis.*

In paragraph 19 it is pointed out that we should realise in the future Rs. 12-12-0 gross, per quarter of cleaned heartwood. Adopting this figure, the following statement of future revenue and expenditure may be accepted as being as nearly correct as is possible under the circumstances :—

STATEMENT of Financial results of proposed working calculated as above, on *probabilities* only.

—	Annual yield in quarters.	Gross value at Rs. 12-12-0 per quarter.	Cost of extraction at Rs. 0-7-3 per quarter. (*Vide* para. 19.)	Cost of establishment employed on sandal operations alone.	One-fourth cost of pay of D.F.O. at Rs. 800 per mensem and office establishment and four Rangers.
(1)	(2)	(3)	(4)	(5)	(6)
		RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
Average for the 18 years of the felling period.	10,400	1,32,600 0 0	4,712 8 0	9,384 0 0	4,200 0 0
For the 6 years following the felling period.	18,500	2,35,875 0 0	8,382 13 0	9,384 0 0	4,200 0 0
When the forest is in full bearing.	34,300	4,37,325 0 0	15,042 13 0	9,384 0 0	4,200 0 0

—	Cost of tending and cultural operations.	One-fourth value of depreciation and interest calculated at 10 per cent. of the capital expenditure on roads and buildings prescribed in the W.P.	Cost of coupe lines.	Total cost (columns 3 to 8).	Balance (Net Revenue) (Column 2, *minus* Col. 9).
	(7)	(8)	(9)	(10)	(11)
	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.
Average for the 18 years of the felling period.	2,155 2 0	2,452 0 0	300 0 0	23,203 10 0	1,09,396 6 0
For the 6 years following the felling period.	2,155 2 0	2,452 0 0	300 0 0	26,873 15 0	2,09,001 1 0
When the forest is in full bearing.	2,155 2 0	2,452 0 0	300 0 0	34,033 15 0	4,03,291 1 0

RS. A. P.

Note.—Net profit in last two years, was as follows :— In 1912-13 ... ... 1,16,975 3 1.
In 1913-14 ... ... 1,17,127 12 0.

This does not include cost of tending and cultural operations, nor any part of the cost of the Office establishment, District Forest Officer's pay, etc.

43. *Collection of data and upkeep of record and control forms.*—In addition to the control books prescribed in the Forest Code for areas under Working-Plan, *i.e.*, forms 5 and 6 and the control journal, a sandalwood register and a sandalwood "Control Map" must be maintained in the District Forest Office. The Sandalwood register will show the size and age of trees felled, whether they were healthy, dying or dead, and the weight of cleaned heartwood obtained from each tree. This record will be of the greatest value, when the Working-Plan is being revised, in fixing the age and girth at which the volume increment of heartwood

culminates, and so in fixing the rotation. This record should be in the following form, each range being entered separately :—

Serial number of tree. (1)	Date of girdling, if any. (2)	Date of felling. (3)	Girth at breast height. (4)	Age. (5)	Weight of rough cleaned wood. (6)	Weight of heartwood. (7)	Locality of tree. (8)	Remarks. (9)

[*N.B.*—Column 5 cannot be filled up in the case of all trees as the subordinates will not have time for the ring counting. A certain number of trees each year should, however, have their rings counted by the District Forest Officer himself and the Range Officer, and the entry made in column 5 for these trees only. If the surface of the stumps is planed smooth with a good sharp smoothing plane the rings become clearly visible. It may also not be possible to fill up column 7, in all cases—*vide* section 21 of Appendix No. II.]

On the "Control Map" will be marked the coupes that have been worked, with the year of working; and also the position of "specially protected blocks," "sample plots," and "Taungya areas," with the years of their initiation and subsequent tendings, and, in the case of "Taungya" areas, re-appropriation by the State.

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APPENDIX I.

MAPS.

APPENDIX II.

Felling Rules.

Selection, felling, cleaning and classification must be conducted in accordance with the following rules:—

The work of selection and marking will be commenced early in the year, not later than the beginning of May, so that the trees may be all marked, and felling estimates submitted and sanctioned before the beginning of the South-West monsoon; actual felling operations must be commenced directly the rain has made the ground sufficiently soft for easy working.

2. The Deputy Ranger in charge will first divide the coupes up into sub-coupes of some two or three hundred acres each, make a tracing of the 4-inch map (or 16-inch if available) and mark the sub-coupes on it. This subdivision should be as far as possible in accordance with natural features or along existing well marked boundary or fire lines.

3. The sub-coupes should be numbered serially; they are for the purpose of regularising the subsequent working. Selection and marking will be completed in one sub-coupe before it is commenced in the next, as also felling, cleaning and transport to depot; and similarly, in the following year, tending and cultural operations must be completed in each sub-coupe before another is taken up.

4. The Deputy Ranger will then in person select for felling and number the following:—

(1) all dead trees, both those standing and those that have fallen, and

(2) all dying trees,—that is to say such trees as he considers will not survive until the next Felling Cycle, *i.e.*, for six years.

N.B.—For the proper selection of these trees it s necessary that the Deputy Ranger should proceed through the jungle with a line of coolies at short intervals from each other, so that no trees may be missed out. If he just wanders about with one or two coolies in a haphazard way he cannot but miss out a large number of trees.

The trees in these two classes must be numbered serially in two separate series as they are to be treated differently, the dead trees being felled in the same year as that in which they are marked, and the dying trees being girdled and left standing for two more years to die and dry slowly.

5. The Deputy Ranger will mark the selected trees by cutting a deep blaize in them, at the height at which he measures them, and on this stamping the serial number with metal punches, and a hammer. All the blaizes should be on the same side of the tree. On the opposite side and at the foot of each tree on a smaller blaize he will hammer-mark the tree with a special hammer that will be provided for the purpose.

N.B.—Ten metál punches for this marking bearing the numbers 1 to 9 and zero and a heavy hammer can be procured at a small cost, or made locally. The figures should not be less than an inch in length. Marking in this manner will take less time than does the present method of painting the figures in tar with the crushed end of a stick and will eventually come cheaper than buying an annual supply of tar; moreover the numbers will be permanent which marking with tar is not.

6. As he selects and numbers each tree the Deputy Ranger will mark its position by a circle with its serial number in the centre thus (10), as accurately as possible on his tracing of the 4 or 16-inch map. The dying trees, which are to be girdled, will be differentiated from the dead ones in this tracing by having the letter G inserted (thus $\frac{10}{G}$). The Deputy Ranger will also enter in the tracing any features in the landscape such as big well known trees or rocks, old tanks, nallas, etc., near which the selected sandal trees stand, to facilitate the subsequent location of them when felling operátions commence.

7. He will also at the same time measure the tree and enter its serial number, girth at 4 feet from the ground, probable height to which heartwood extends, and approximate situation, in the felling lists, Forms 1-A and 1-B appended. In Form 1-A will be entered serially the dead trees and in Form 1-B, the dying trees.

8. On completion of the marking he will submit a copy of the felling lists and tracing to the Range Officer for check and preparation of estimate for the felling operations.

9. Immediately on receipt of a copy of the sanctioned estimate, which the Range Officer must send him, the Deputy Ranger will commence work. He will begin by girdling the dying trees as described below, leaving the uprooting of the dead ones until such time as the ground has been sufficiently moistened by rain to make the work easy.

10. As already stated each sub-coupe must be completed before another is taken in hand.

11. Of the selected trees those that are dying will be girdled at about 1 foot from the base of the tree; not only the bark must be removed but also the sapwood. These trees will then be left for two years and extracted when they are dead and dry, by uprooting them as described below for "dead trees." The dead trees will be uprooted by digging round them, deep enough to secure all side roots and rootlets containing heartwood, and then cutting through the bigger roots so that the trees may fall by their own leverage. No root that contains heartwood of more than the size of a rupee must be left in the ground.

12. On the fall of a tree, the top and small branches containing no heartwood should be lopped off; and all branches containing heartwood should be sawn off flush with the trunk, so that the latter may yield timber as clean as possible, and should be marked with the number of the tree and also with their own numbers on the sawn section as described below.

N.B.—Under no circumstances may axes or bill hooks be used for separating branches or roots which contain heartwood from the main trunk.

13. The main root should be sawn off at the crown so that as little stem wood as possible be taken with it, as the quality of root and stem wood differs considerably, the root wood commanding the higher price.

The number of the tree and also its own number must be noted on the sawn section of the main root, and also on such other roots as contain heartwood, and as have become separated from the main root, in the same way as on the branches.

14. In cases where extraction of dead trees is in progress, however, some of them will be sufficiently small to allow of export without any sub-division. In these cases the trees will be numbered, rough-cleaned and extracted whole. And in other cases if the rough-cleaned stems and branches can be carried out as they are, they should of course not be billetted; but if any of them are too heavy they should be divided up into 3 foot-lengths by sawing, the sawdust being carefully preserved.

Care should be taken to get pieces as straight and as free from knots and cracks as possible.

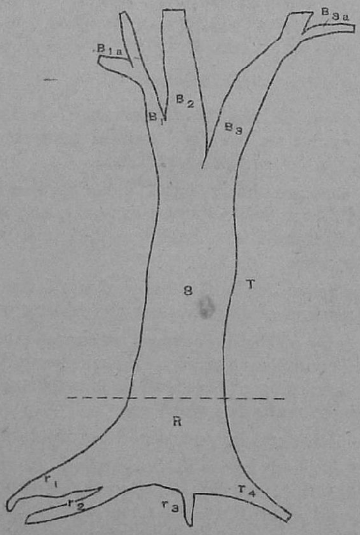
15. The trunk, branches and roots must then be "rough-cleaned" by chipping off the bark and a portion of the sapwood with adzes or bill hooks. A fairly substantial covering of sapwood must however be left over the heartwood and in no case must the latter be exposed in any place. If this rule is strictly adhered to and if the ends of all pieces are hammer-marked as laid down in paragraph 16 below, theft by cutting off pieces of heartwood while in transit will be impossible.

16. Immediately after a tree has been felled and dressed as above described it must be transported to the forest depot where its root and billet wood must be separately weighed on scales, and then all its pieces hammer-marked at *both* ends, numbered at their bigger ends, and then their lengths and middle girths measured and entered, together with the weight of the tree, in lists in Forms 2-A and 2-B; Form 2-A will refer to the naturally dead trees extracted from the current year's coupe, and Form 2-B to the trees killed by girdling extracted from the coupe worked two years previously.

The weights will be recorded in quarters and pounds. When a sufficient quantity of the wood has thus been collected in the forest depot it will be despatched to the sale depot with copies of the lists in Forms 2-A and 2-B, where the Range Officer will take charge of it.

17. On receipt of the wood and the lists in the sale depot the Ranger will check the measurements, and reconstruct a certain number of the trees, so as to satisfy himself that all the wood has been received correctly.

18. The diagram given below will illustrate the instructions regarding numbering of billets, branches and roots given above.



In this diagram the tree number is 8; R represents the main root; r_1, r_2, r_3, r_4 represent side roots.

T represents the trunk. If billetted the billets will be numbered T_1, T_2, T_3, etc., B_1, B_2, B_3, represent main branches and B_1a, B_3a, their respective side branches. Should the main branches be billetted the pieces will be numbered $B_1\alpha$, $B_1\beta$, $B_1\gamma$, and so on.

It should be borne in mind that every piece must bear the tree number and also its own distinctive letter and number. Thus the stem of the tree if taken out in one piece would bear the mark 8 T; the largest root would bear the mark 8 R, and the right-hand main branch in the diagram would be 8 B_3.

19. When all the trees prescribed for felling in the year have been received, and their weights and measurements checked, the Range Officer will prepare lists in Forms 2a and 2b and submit them to the District Forest Officer.

20. Final cleaning must then be taken up. Great care and very strict supervision is necessary during this operation as no heartwood must be wasted, and the billets when finished must be smooth and free from excrescences, knots and cuts, as this greatly enhances their value. This final cleaning is to be done as follows :—

(*a*) First if it has not already been done the root is sawn off at the crown and all large pieces are sawn up into 3-foot length.

(*b*) Then a final cleaning is made in which all the sapwood is cut away but no heartwood.

(*c*) Then the first four classes of billetwood are planed smooth with large spoke shaves. (These cost 10 annas each if made locally out of old files.)

N.B.—The chips resulting from this cleaning are carefully sorted and all pieces which by chance do contain heartwood are separated from the others.

21. After this final cleaning the heartwood of each tree must be weighed separately and the weight reported to the District Forest Officer in Forms 3-A and 3-B, again keeping the trees killed by girdling separate from those that have died naturally; from these forms 1-A and B, 2-A and B and 3-A and B the sandalwood register prescribed in paragraph 43 above,—with the exception of column 5,—will be posted up in the District Forest office. This is of the utmost importance as on the data contained in this register, if properly kept, it should be possible at the end of the felling period, when a final Working Plan is being prepared, to calculate with more or less exactness the rotation which will give the maximum amount of heartwood. There are no data available by which this can now be accurately calculated as these weights and measurements have nowhere been recorded, though in all the sandalwood Working Plans I have seen, the keeping of such a record has been prescribed. If however it is found that a great deal of time and labour is required to keep each tree separate until final cleaning is complete and weighment made, this may be done in the case of a limited number of trees only each year, say the 50 largest trees felled in each Working Circle, and the full statistics kept for these trees only. These should as far as possible be the same trees as those of which the ring countings have been made. In this case, for the other trees, all columns must be filled up in the Sandalwood register except columns 5 and 7.

22. The wood will then be sorted and classified as follows :—

Class.	Name.	Description.
1	Vilayat Budh or first-class billets	Billets free from defects and weighing not more than 20 lbs.
2	Chinna Budh or second-class billets	Do. do. weighing from 10 to 20 lbs.
3	Panjam or third-class billets	Do. do. do. 5 to 10 lbs.
4	Ghotla or short billets	Billets without defects but less than 3 feet in length; weight immaterial.
5	Ghat Badala	Billets of 10 lbs. and over with minor defects, such as knots, small cracks and hollows.
6	Bagaradad	Do. do. but weighing less than 10 lbs.
7	Roots, first class	Weighing not less than 15 lbs.
8	Do. second class	Do. do. 5 lbs.
9	Do. third class	Less than 5 lbs. and all side roots.
10	Jajpokal, first class	Hollow and ragged pieces weighing not less than 7 lbs.
11	Do. second class	Do. do. weighing not less than 3 lbs.
12	Ain Bazar	Sound and unsound pieces weighing not less than 1 lb.
13	Cheria	Do. do. weighing not less than ½ lb.
14	Ain Chilta	Chips and small pieces of pure heartwood.
15	Hatheri Chilta	Very small chips and small pieces of heartwood (obtained in planing first four classes).
16	Mulva Chilta	Largest chips of mixed heart and sapwood.
17	Basola Bakni	Small chips do. do.
18.	Saw dust.	

23. After classification each class will be weighed and stacked separately, and the weight and number of pieces in each class will be reported to the District Forest Officer.

FORM 1-A.

LIST of sandalwood trees marked for felling in coupe of series in Working Circle during the year 19 -19 .

Serial number of tree.	Girth of tree at breast height.	Length or height of stem up to probable heartwood limit.	Situation of tree.	Remarks.

Dated Range, (Signature) Deputy Ranger.

FORM 1-B.

LIST of sandalwood trees marked for girdling in coupe of series in Working Circle during the year 19 -19 .

Serial number of tree.	Girth of tree at breast height.	Length or height of stem up to probable heartwood limit.	Situation of tree.	Remarks.

Dated Range, (Signature) Deputy Ranger.

FORM 2-A.

Dead trees marked and extracted in 1901-02.

LIST of measurements of roughly dressed sandalwood trees extracted from coupe No. of series in Working Circle in 19 -19 .

Serial number of tree as per Form I-a.	Description of pieces.		Length.	Middle girth.	Weight.		Date of felling.	Date of weighment.	Remarks.
					Quarters.	Pounds.			
			FT. IN.	FT. IN.					
2	Main roots ...	$2\ R_1$	2 6	2 0					
		$2\ R_2$	1 0	0 9					
	Side roots ...	$2\ r_1$	0 9	0 6					
		$2\ r_2$	0 6	0 3					
	Trunk	$2\ T_1$	3 0	2 2					
		$2\ T_2$	2 6	1 10	8	3	8th July 1901.	10th July 1901.	
	Branches ...	$2\ B_1$	2 0	1 4					
		$2\ B_{2-a}$	1 6	1 0					
		$2\ B_{2-b}$	1 0	0 9					
	Side branches ...	2 b	0 6	0 3					

Dated Range,

Deputy Ranger / Range Officer

FORM 2-B.

Dying trees girdled in 1901-02 *and extracted in* 1903-04.

LIST of measurements of roughly dressed sandalwood trees extracted from coupe No. of series in Working Circle in 19 -19 .

Serial number of tree as per Form I-a.	Description of pieces.		Length.		Middle girth.		Weight.		Date of felling.	Date of weighment.	Remarks.
			FT.	IN.	FT.	IN.	Quarters.	Pounds.			
2	Main roots ...	2 R_1	2	6	2	0	8	3	8th July 1901.	10th July 1901.	
		2 R_2	1	0	0	9					
	Side roots ...	2 r_1	0	9	0	6					
		2 r_2	0	6	0	3					
	Trunk ...	2 T_1	3	0	2	2					
		2 T_2	2	6	1	10					
	Branches ...	2 B_1	2	0	1	4					
		2 B_{2-a}	1	6	1	0					
		2 B_{2-b}	1	0	0	9					
	Side branches ...	2 b	0	6	0	3					

Range,

Dated

Deputy Ranger
Range Officer

FORM 3-A.

Trees that died naturally.

STATEMENT showing weight of heartwood after final cleaning of each sandalwood tree felled in coupe of series in Working Circle during 19 -19 .

Serial number of tree as per Form I-a.	Description of wood.	Date of weighment.	Weight.		Difference in weight between Forms II-a and III-a.	Remarks.
			Quarters.	Pounds.	lbs.	
1	Rootwood	10th October 1901.	1	5	5	
	Billetwood	Do.	6	20	20	
2	Rootwood	Do.	1	15	11	
	Billetwood	Do.	5	10	17	

Range.

Dated

Range Officer.

FORM 3-B.

Trees killed by girdling.

STATEMENT showing weight of heartwood after final cleaning of each sandalwood tree felled in coupe of series in Working Circle during 1903-04.

Serial number of tree as per Form I-b.	Description of wood.	Date of weighment.	Weight.		Difference in weight between Forms II-b and III-b.	Remarks.
			Quarters.	Pounds.	lbs.	
1	Rootwood	10th October 1903.	1	5	5	
	Billetwood	Do.	6	20	20	
2	Rootwood	Do.	1	15	11	
	Billetwood	Do.	5	10	17	

Range,

Dated

Range Officer.

APPENDIX III.

List of trees found associated with Sandal and of those which have been proved to act as Hosts to in the South Vellore North Salem and South Salem districts.

Natural order.	Associates of Sandal. Botanical name.	Associates of Sandal. Vernacular name	Whether or not the actual root connection with the Sandal has been observed.	Remarks.
	Trees.			
Leguminosæ ...	1. Albizzia odoratissima ...	Vagai and Selai ...	Yes.	Very good.
	2. Albizzia amara	Turingi and Usil ...	"	
	3. Acacia leucophlœa ...	Velvayalam	"	A very good host.
	4. Dalbergia latifolia ...	Iruvadi	"	
	5. Dalbergia paniculata ...	Velangu or pachalai.	...	
	6. Dalbergia lanceolaria ...	Velangu or Gatti pachalai.	...	
	7 Pterocarpus Marsupium ...	Vengai	...	
	8. Pongamia glabra	Pungam	Yes.	
	9. Butea frondosa	Murukan	"	
	10. Cassia fistula ...	Konnai	...	
	11. Tamarindus indica ...	Puliyamaram ...	...	
Rhamneæ	12. Zizyphus xylopyrus ...	Kottai	...	
	13. " jujuba ...	Elandai	...	
Rutaceæ	14. Feronia elephantum ..	Vela	Yes.	
Burseraceæ ...	15. Garuga pinnata	Karuvembu	...	
	16. Proteum caudatum ...	Pachai Kiluvai ...	Yes	
Meliaceæ	17. Melia Azadirachta ...	Veppam and Vembu.	"	
	18. Chloroxylon swietenia ...	Porasu	"	
Celastrineæ ...	19. Elæodendron glaucum ...	Keeri	...	
Sapindaceæ ..	20. Schleichera trijuga ...	Poovatti	...	
Anacardiaceæ ...	21. Mangifera indica	Mamaram	...	
	22. Buchanania latifolia ...	Kat maa	...	
	23. Odina Wodier	Woodian	...	
	24. Semecarpus anacardium ...	Serankottai	...	
Combretaceæ	25. Terminalia paniculata ...	Puluve	...	
	26. " Chebula ...	Kadukkai	...	
	27. " belerica ...	Tani	...	
	28. " tomentosa	Kari madi, Kali madi.	...	
	29. " Arjuna ...	Attu madi	...	
	30. Anogeissus latifolia ...	Namme	Yes.	
	31. Gyrocarpus Jacquini ...	Tanaku	...	
Myrtaceæ	32. Eugenia Jambolana ...	Nagai	...	
Melastomaceæ ...	33. Memecylon edule	Alli maram	Yes.	
Rubiaceæ	34. Canthium Didymum ...	Nekkini	"	
	35. Morinda citrifolia	Nona	...	
Sapotaceæ	36. Mimusops indica ...	Magadam	...	
	37. " hexandra ...	Palai	...	
Ebenaceæ	38. Diospyros melanoxylon ...	Karunthumbi ...	..	
	39. " Chloroxylon ...	Karuvakkanâi ...	Yes.	
	40. " montana ...	Vakkanai	...	
Apocynaceæ ...	41. Wrightia tinctoria ...	Palai	...	
	42. " tomentosa ...	Palai	Yes.	
Loganiaceæ ...	43. Strychnos Nux-vomica ...	Yetti	...	
	44. " potatorum ...	Tettan kottai ...	...	
Verbenaceæ ...	45. Premna tomentosa ...	Podunganari	Yes.	
	46. Vitex altissima	Maladai	"	
Euphorbiaceæ ...	47. Mallotus phillippinensis ...	Kamila, Kapila ...	...	
Urticaceæ ...	48. Holoptelea integrifolia ...	Avali	...	
Simarubeæ ...	49. Ailanthus excelsa	Peemaram	...	
Annonaceæ ...	50. Anona squamosa	Seetha...	...	
Tiliaceæ	51. Grewia tiliæfolia	Thadachi	...	
Lineæ	52. Erythroxylon monogynum.	Sembulichan	Yes.	
	Shrubs and creepers.			
Leguminosæ ...	53. Acacia Intsia	Seengai	Yes.	
	54. " pinnata	......	"	
	55. Pterolobium indicum ...	Karindu	"	
	56. Cassia auriculata	Avarum	...	
Rhamneæ ...	57. Zizyphus Oenoplia ...	Surai	Yes.	
	58. Scutia indica	......	"	
Rutaceæ	59. Atalantia monophylla ...	Kat elimichan ...	"	
	60. Limonia acidissima ...	Nay vela	"	
	61. Todalia aculeata	......	"	
Meliaceæ ...	62. Cipadessa fruticosa ...	Sevattai	...	
Sapindaceæ ...	63. Dodonea viscosa ...	Virali	Yes.	
Cronaceæ ...	64. Alangium Lamarckii ...	Alanji	...	

APPENDIX III—*cont.*

List of trees found associated with Sandal and of those which have been proved to act as Hosts to it in the South Vellore, North Salem and South Salem districts—*cont.*

Natural order.	Associates of Sandal.		Whether or not the actual root connection with the Sandal has been observed.	Remarks.
	Botanical name.	Vernacular name.		
Rubiaceæ ...	65. Webera corymbosa ...	Terani ...	Yes.	
	66. Randia dumetorum ...	Karai	„	
	67. Randia uliginosa	......	...	
	68. Ixora parviflora	......	Yes.	
Apocynaceæ ...	69. Carissa Carandas	Kila sedi	...	
Euphorbiaceæ ...	70. Flueggia microcarpa ...	......	...	
	71. „ leucopyrus ...	Veppula	Yes.	
	72. Jatropha curcas	Kātāmanakku ...	...	
Urticaceæ ...	73. Streblus asper	......	...	
Vixineæ	74. Flacourtia Ramontchii ...	......	...	
Tiliaceæ	75. Grewia sp.	Udupai, Poonai-podukku.	...	
Yleaceæ	76. Jasminum sp. (auriculatum ?).	Kattu malligai ...	Yes.	
Casteæ	77. Opuntia Dillenii (prickly-pear).	Sappāthi Kalli, Nāgāthali.	„	
Verbenaceæ ...	78. Lantana aculeata	......	„	
Gramineæ ...	79. Bambusa arundinacea ...	Mungil, Peruvarai ...	„	
	80. Dendrocalamus strictus ...	Mungil, Siruvarai ...	„	
Anacardaceæ ...	81. Rhus mysorensis	Seppula	...	

N.B.—Reference may also be made in this connection to the "List of Sandal Hosts" appended to Part 2 of Barber's "Studies in Root Parasitism."

APPENDIX IV.

Past Revenue and Expenditure.

Revenue.		Expenditure.													
		Felling and transport.							Carting.			Final cleaning.			
		Felling, rough cleaning and transport to Forest Depot.			Transport to the plains.		Total expenditure on extraction by coolies.								
Quantity of sandalwood sold in quarters.	Amount realised.	Quantity of wood in quarters.	Rate.	Amount spent.	Rate.	Amount spent.	Total amount spent.	Rate per quarter.	Quantity in quarters.	Rate.	Amount.	Quantity in quarters.	Rate.	Amount.	Total expenditure.
1904–05.															
Tirupattūr Range.															
QRS. LB. OZ.	RS. A. P.	QRS. LB. OZ.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	QRS. LB. OZ.	RS. A. P.	RS. A. P.	QRS. LB. OZ.	RS. A. P.	RS. A. P.	RS. A. P.
1,295 14 0	8,728 0 7	1,572 6 0	5 mds. per Re. 0 3 2 per md.	305 14 6	Included in col. 3 to 5.		305 14 6	5 mds. per Re. 0 3 2 per md.	1,572 6 0	Rs. 2 for 40 mds. 0 0 10 per md.	79 0 0	1,384 12 0	Cooly. 0 0 5 per md.	35 0 3	419 4 9
1905–06.															
Tirupattūr Range.															
1,046 13 0	3,251 0 0	1,096 27 0	5 mds. per Re. 0 3 2 per md.	219 0 0	Included in col. 3 to 5.		219 0 0	0 3 2 per md.	1,096 27 0	Rs. 2 for 40 mds. 0 0 10 per md.	55 0 0	904 8 0	Cooly. 0 0 7 per md.	32 8 11	306 8 11
Chengam Range.															
2 8 0	15 0 0	0 64 0	No expenditure.		...	...	...	...	...	...	...	...	...	...	...
Polur Range.															
3,973 20 0	26,811 12 1	4,248 24 0	11 0 0 per ton. 0 2 2½ per md.	585 0 0	5 0 0 per ton. 0 1 0 per md.	191 0 0	776 0 0	0 2 10 per md.	4,204 18 0	2 8 0 and 12 0 0 per ton. 0 0 6 and 0 2 3 per md.	218 2 9	4,184 12 0	0 1 6 per md.	352 5 6	1,346 8 3

1906-07.															
Tirupattūr Range.															
1,352 14 0	9,050 13 3	1,385 18 0	5 mds. per Re. or 0 3 2 per md.	277 2 0	Included in col. 3 to 5.		277 2 0	0 3 2 per md.	1,385 15 0	Rs. 2 for 40 mds. 0 0 10 per md.	69 0 0	1,231 11 0	Cooly. 0 0 11 per md.	68 0 0	414 2 0
Chengam Range.															
31 15 8	192 1 0	35 8 8	No expenditure.		...	...	...	...	...	...	...	...	...	...	...
Polur Range.															
3,858 18 0	23,553 3 9	3,849 4 0	11 0 0 per ton. or 0 2 2¼ per md.	529 0 0	5 0 0 per ton. 0 1 0 per md.	201 8 6	730 8 6	0 3 0 per md.	3,849 4 0	2 8 0 and 12 0 0 per ton. 0 0 6 0 2 3 per md.	283 6 0	3,648 8 0	0 1 6 per md.	342 7 6	1,356 6 0
1907-08.															
Tirupattūr Range.															
1,054 7 0	6,651 13 0	1,101 25 0	5 mds. and 4 mds. per Re. 0 3 2 and 0 4 0 per md.	250 8 0	Included in col. 3 to 5.		250 8 0	0 3 8 per md.	1,101 25 0	Rs. 2 for 40 mds. 0 0 10 per md.	65 7 0	1,035 19 8	Cooly. 0 1 1 per md.	67 11 0	383 10 0
Chengam Range.															
1 7 0	5 10 5	0 35 0	No expenditure.		...	...	...	...	...	...	...	...	...	...	...
Polur Range.															
5,082 16 0	32,353 8 9	5,365 13 0	11 0 0 per ton. 0 2 2½ per md.	738 6 0	Rs. 5 per ton or 0 1 0 per md	310 2 0	1,048 8 0	0 3 2 per md.	5,282 10 0	2 8 0 and 1 0 0 per ton. 0 0 6 0 2 2¼ per md.	410 9 0	5,074 0 0	0 1 6 per md.	465 7 7	1,924 8 7

APPENDIX IV—*cont.*

Past Revenue and Expenditure—cont.

Revenue.		Expenditure.														
		Felling and transport.							Carting.			Final cleaning.			Total expenditure.
		Felling, rough cleaning and transport to Forest Depot.			Transport to the plains.		Total expenditure on extraction by coolies.								
Quantity of sandalwood sold in quarters.	Amount realised.	Quantity of wood in quarters.	Rate.	Amount spent.	Rate.	Amount spent.	Total amount spent.	Rate per quarter.	Quantity in quarters.	Rate.	Amount.	Quantity in quarters.	Rate.	Amount.	
							1908–09.								
							Tirupattūr Range.								
QRS. LB. OZ. 994 20 6	RS. A. P. 6,177 2 11	QRS. LB. OZ. 1,190 14 0	RS. A. P. 5 mds. per Re. or 0 3 2 per md.	RS. A. P. 216 9 1	RS. A. P. Included in col. 3 to 5.	RS. A. P.	RS. A. P. 216 9 1	RS. A. P. 0 3 2 per md.	QRS. LB. OZ. 1,190 14 0	RS. A. P. Rs. 2 for 40 mds. 0 0 10 per md.	RS. A. P. 52 12 0	QRS. LB. OZ. 1,155 4 0	RS. A. P. Cooly. 0 1 0 per md.	RS. A. P. 71 4 0	RS. A. P. 340 9 1
							Chengam Range.								
1,198 16 8	6,240 12 8	1,785 10 0	0 2 0 per md.	225 4 8	0 2 0 per md.	229 11 4	455 0 0	0 4 1 per md.	1,760 18 0	2 12 0 for 49 mds. 0 0 11 per md.	81 10 7	1,069 20 8	0 1 6 per md.	190 7 1	697 1 8
							Polur Range.								
5,488 25 0	32,862 9 7	5,788 14 0	11 0 0 per ton. 0 2 2½ per md.	795 5 4	5 0 0 per ton	294 10 10	1,090 0 2	0 3 0 per md.	5,698 18 0	2 8 0 and 11 0 0 per ton. 0 0 6 0 2 2½ per md.	452 2 2	5,350 10 8	0 1 6 per md.	516 6 0	2,058 8 4
							1909–10.								
							Tirupattūr Range.								
1,199 18 8	7,609 5 3	1,730 14 0	5 mds. and 4 mds. per Re. 0 3 2 and 0 4 0 per md.	352 2 10	Included in col. 3 to 5.		352 2 10	0 3 4 per md.	1,730 14 0	2 0 0 for 40 mds. 0 0 10 per md.	93 11 5	1,459 18 0	Cooly. 0 1 2 per md.	103 9 2	549 7 5

Chengam Range.															
4,846 14 8	37,679 5 6	5,687 13 0	0 2 0 per md.	1,187 4 2	0 1 6 and 0 2 0 per md.	810 9 6	1,997 13 8	0 5 7 per md.	5,604 2 8	2 8 0 2 12 0 for 49 mds. 0 0 10 0 0 11 per md.	213 12 8	5,340 12 0	0 1 6 per md.	832 7 8	3,044 2 0
Polur Range.															
3,852 2 0	26,165 14 3	4,457 16 0	11 0 0 per ton. 0 2 2½ per md.	610 4 0	5 0 0 per ton. 0 1 0 per md.	212 3 0	822 7 0	0 2 11 per md.	4,457 16 0	2 8 0 and 11 0 0 per ton. 0 0 6 0 2 2½ per md.	336 10 1	4,214 3 0	0 1 6 per md.	549 7 5	1,708 8 6
1910-11.															
Tirupattūr Range.															
1,613 2 8	9,943 8 0	1,894 20 4	5 mds. per Re. 0 3 2 per md.	392 8 11	Included in col. 3 to 5.		392 8 11	0 3 5 per md.	1,894 20 4	Rs. 2 for 40 mds. 0 0 10 per md.	80 8 0	1,838 15 4	Cooly. 0 0 11 per md.	101 15 0	574 15 11
Chengam Range.															
4,209 26 0	25,974 2 6	5,089 25 8	0 2 6 per md.	948 6 11	0 2 0 per md.	740 14 7	1,689 5 6	0 5 2 per md.	5,029 11 2	2 12 0 and 2 8 0 for 49 mds. 0 0 10 0 0 11 per md.	285 8 0	4,362 5 8	0 1 5 per md.	539 9 2	2,514 6 8
Polur Range.															
5,816 11 8	37,143 9 6	6,820 7 0	11 0 0 per ton. 0 2 2½ per md.	932 0 2	Rs. 5 per ton. 0 1 0 per md.	452 1 0	1,384 1 2	0 3 1 per md.	6,714 9 0	2 8 0 and 11 0 0 per ton 0 0 6 0 2 2½ per md.	635 12 0	5,9[illegible]2 19 9	0 1 6 per md.	1,124 8 2	3,144 5 4
1911-12.															
Tirupattūr Range.															
736 9 8	4,906 2 0	212 0 0	4 mds. per Re. 0 4 0 per md.	53 0 0	Included in col. 3 to 5.		53 0 0	0 4 0 per md.	212 0 0	Rs. 2 for 40 mds. 0 0 10 per md.	10 6 0	1,821 7 0	Cooly. 0 0 7 per md.	76 4 0	139 10 0

APPENDIX IV—*cont.*

Past Revenue and Expenditure—cont.

Revenue.		Expenditure.													
		Felling and transport.							Carting.			Final cleaning.			Total expenditure.
		Felling, rough cleaning and transport to Forest Depot.			Transport to the plains.		Total expenditure on extraction by coolies.								
Quantity of sandalwood sold in quarters.	Amount realised.	Quantity of wood in quarters.	Rate.	Amount spent.	Rate.	Amount spent.	Total amount spent.	Rate per quarter.	Quantity in quarters.	Rate.	Amount.	Quantity in quarters.	Rate.	Amount.	
							1911–12—*cont.*								
							Chengam Range.								
QRS. LB. OZ.	RS. A. P.	QRS. LB. OZ.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	RS. A. P.	QRS. LB. OZ.	RS. A. P.	RS. A. P.	QRS. LB. OZ.	RS. A. P.	RS. A. P.	RS. A. P.
5,283 27 0	44,372 1 5	6,272 7 8	0 2 6 per md.	951 5 10	0 2 0 and 0 4 0 per md.	802 11 11	1,754 1 9	0 4 6 per md.	6,062 20 10	2 12 0 for 49 mds. 0 0 11 per md.	313 11 0	5,341 8 0	0 1 5 per md.	584 8 5	2,652 5 2
							Polur Range.								
3,405 25 8	27,149 12 3	5,610 7 0	11 0 0 per ton. 0 2 2½ per md.	743 6 0	5 0 0 per ton. 0 1 0 per md.	245 3 6	988 9 6	0 2 9 per md.	5,584 12 0	2 8 0 and 11 0 0 per ton. 0 0 6 0 2 2½ per md.	814 10 1	3,049 10 8	0 1 6 per md.	771 11 8	2,574 15 3
							1912–13.								
							Tirupattūr Range.								
23 5 10	23,531 3 9	2,264 1 0	5 mds. per Re. 0 3 2 per md.	450 1 6	Included in col. 3 to 5.		450 1 6	0 3 2 per md.	2,192 8 8	2 0 0 for 40 mds. 0 0 10 per md.	124 3 5	2,098 2 10	Coly. 0 1 1 per md.	145 13 4	719 14 3

Chengam Range.															
5,328 24 0	55,166 14 7	5,745 4 0	0 2 6 per md.	1,143 9 9	0 2 0 and 0 4 0 per md.	727 4 7	1,870 14 4	0 5 2 per md.	5,722 12 0	2 12 0 for 49 mds. 0 0 11 per md.	349 4 7	4,819 13 3	0 1 5 per md.	581 3 8	2,701 6 7
Polur Range.															
6,164 25 1	44,224 8 6	6,420 1 0	11 0 0 per ton. 0 2 2½ per md.	968 9 11	5 0 0 per ton. 0 0 6 per md.	331 11 10	1,300 5 9	0 3 3 per md.	6,319 4 0	2 8 0 and 11 0 0 per ton. 0 0 6 0 2 2½ per md.	560 8 0	5,183 6 5	0 1 6 per md.	665 5 2	2,526 2 11

APPENDIX V.

Details of Settlement of Reserves.

Name of Reserve.	Date of *Fort Saint George Gazette* notifying the Reserve under Section 4.	Notification under Section 16.		Demarcation.	
		Notification number and date.	Number and date of Board's Proceedings.	When begun.	When completed.
CHENGAM RANGE.					
Tenmalai Reserved Forest ...		323		Nov. 1898	June 1899
Nallapattu Reserved Forest ...	12 June 1889	325 } 12 July 1892	433, 11 Aug. 1892	Feb. 1906	May 1907
Pilamaruthur Reserved Forest ...		324		Feb. 1906	Do.
Chinnasamudram Reserved Forest.	14 Mar. 1884	284, 9 Aug. 1887	508, 8 Sept. 1887	Dec. 1893	Mar. 1894
POLUR RANGE.					
Patraikad Reserved Forest ...	4 June 1886	181			
Veerappanur Reserved Forest ...	9 Nov. 1886	180 } 29 June 1888	388, 23 July 1888	...	...
Puthur Reserved Forest	4 June 1886	178			
Malayalam Reserved Forest ...	4 Oct. 1887	353, 6 Aug. 1891	401, 9 Sept. 1891	...	...
Mulakad Reserved Forest ...	17 Aug. 1890	12, 15 Feb. 1894	13, 14 Mar. 1894	...	...
TIRUPATTUR RANGE.					
Singarapet Extension Reserved Forest.	31 Mar. 1885	211, 23 May 1887	366, 30 June 1887	...	...
Singarapet Reserved Forest ...		257, 8 July 1887	429, 25 July 1887	...	...
Inner Javadis Reserved Forest ...	14 Dec. 1893	125, 19 Mar. 1895	203, 17 April 1895	...	...
Mambakkam Reserved Forest ...	31 Mar. 1885	436, 1 Nov. 1886	668, 10 Dec. 1886	..	...
Andiappanur Reserved Forest ...	18 Aug. 1891	514, 24 Oct. 1894	692, 10 Nov. 1894	...	...
Pungulam Reserved Forest ...	31 Mar. 1885	386, 2 Nov. 1886	606, 6 Nov. 1886	...	...
Nagaluthu Extension Reserved Forest.	11 April 1899	306, 19 June 1900	295, 13 July 1900	...	...
Nagaluthu Reserved Forest ...	31 Mar. 1885	388, 2 Nov. 1886	18, 17 Jan. 1887	...	...
Mangalam Extension Reserved Forest.	4 Dec. 1899	315, 26 June 1906	161, 12 July 1906	...	...
Mangalam Reserved Forest ...	31 Mar. 1885	384, 2 Nov. 1886	18, 17 Jan. 1887	...	...
Jalarpet Reserved Forest ...					
NORTH VELLORE.					
Thellai Reserved Forest	9 Nov. 1886	179, 29 June 1888	388, 23 July 1888	...	...
Arasampattu Reserved Forest ...	7 Oct. 1891	382, 14 July 1893	586, 10 Aug. 1893	...	...

APPENDIX VI.

Details of Enumeration.

(In Diameter classes.)

Name of locality.	Below 1 inch.	2 inches.	3 inches.	4 inches.	5 inches.	6 inches.	7 inches.	8 inches.	9 inches.	10 inches.	11 inches.	12 inches.	13 inches.	14 inches.	15 inches.	16 inches.	17 inches.	18 inches.	Total.
RESERVED FORESTS.																			
Arasampattu	4,403	5,320	6,428	5,276	4,327	3,405	1,802	1,078	697	315	160	84	30	9	2	...	...	...	33,336
Tellai	767	819	1,871	2,617	2,464	2,303	1,826	1,319	862	400	267	177	68	43	23	9	1	5	15,941
Amerdi Plantations	66	262	354	432	357	197	72	34	17	4	5	2	...	...	...	...	...	...	1,802
Veerappanur	15,820	10,011	10,806	8,619	7,039	5,123	3,173	1,925	1,256	671	351	133	25	4	3	...	...	...	64,959
Komattiyur A. B. & C. Blocks.	4,546	6,603	7,479	7,102	4,987	3,052	1,848	1,372	805	270	143	72	5	8	...	2	...	...	38,294
*	10	33	36	63	43	27	13	6	1	..	1	..	...	...	...	.	...	...	233
Puthur	31,944	15,071	14,262	10,249	8,612	8,612	4,981	3,352	2,121	965	607	308	134	85	42	4	1	4	101,354
*	...	9	24	18	9	11	5	3	2	2	...	...	1	...	...	...	...	...	84
Mulakad	1,568	1,515	1,279	947	662	397	199	109	66	24	2	6	2	1	1	1	...	..	6,779
Patrakad	7,937	11,627	11,596	9,355	6,892	4,900	3,190	1,990	1,153	570	308	170	66	51	16	11	3	2	59,837
*	...	4	21	12	10	8	...	2	...	...	...	...	..	...	...	...	...	...	57
Malayalam	302	751	1,103	1,048	861	525	278	165	91	40	10	7	3	2	...	...	...	...	5,186
*	...	...	...	62	49	32	18	11	6	2	...	1	...	...	.	.	..	...	181
Singarapet *	695	2,287	952	584	247	143	52	24	13	5	2	8	2	1		...	...	..	5,015
Singarapet extension	1,298	2,115	1,774	1,648	1,333	1,001	698	473	243	128	60	42	10	6	3	2	1	...	10,835
Inner Javadis	3,127	18,460	15,715	12,216	8,918	6,287	2,908	2,215	1,166	590	915	239	105	52	29	18	5	2	72,967
Mambakkam	6,610	8,731	9,706	8,592	5,467	3,645	2,076	1,146	731	329	154	76	42	23	3	4	...	1	47,343
Andiyappanur	1,352	2,319	2,373	1,675	874	480	179	78	31	23	13	8	13	8	1	...	...	...	9,422
Kottur	6,216	4,872	4,171	1,498	348	149	41	16	5	...	...	...	...	...	...	...	...	..	17,316
Jalarpet	17,751	12,393	11,660	4,117	1,202	857	196	81	43	8	4	1	...	...	...	...	...	...	48,313
Mangalam extension	1,254	1,174	634	188	31	52	8	1	2	2	...	.	...	...	..	...	...	...	3,346
Nagaluthu	6,813	5,232	4,470	1,546	333	279	71	31	20	5	1	3	1	...	...	...	...	...	18,805
Nagaluthu extension	168	114	58	8	7	1	...	...	..	...	..	...	...	...	...	..	...	...	356
Tenmalai	3,969	8,636	6,524	6,834	6,035	5,035	3,505	2,616	1,850	920	566	430	155	95	67	33	14	24	47,308
Nallapattu	2,666	2,757	2,602	2,379	1,774	1,273	799	574	322	200	108	71	11	19	11	8	1	2	15,577
Pelamarathur	334	343	330	184	106	70	45	20	20	11	9	2	...	...	..		..	...	1,474
Total ...	119,606	121,412	116,247	87,121	62,876	47,786	27,947	18,619	11,514	5,480	3,685	1,839	672	402	201	82	26	40	625,565
*	10	46	81	192	136	97	50	27	14	7	4	2	1	...	...	...	...	...	667
UNRESERVED FORESTS.																			
Thongumalai enclosure ...	1,047	1,836	1,803	1,436	1,149	866	494	251	122	41	19	8	1	...	...	...	...	...	9,073
In Arasampattu	100	152	210	179	173	105	57	29	6	5	3	...	...	...	...	...	...	...	1,019
In Tellai	86	221	266	236	263	262	193	147	88	31	22	20	2	1	.	..	1	...	1,839
In Veerappanur	253	292	496	606	629	526	355	249	153	54	47	17	5	1	...	...	...	...	3,683
Komattiyur enclosure ...	1,287	3,039	4,880	4,760	4,300	3,594	2,273	1,670	986	467	256	149	22	8	7	5	...	1	27,704
*	...	1	5	17	12	6	5	2	1	...	...	...	...	...	...	...	...	...	49
In Mulakad	60	67	69	83	71	58	50	39	18	6	2	2	1	...	...	...	...	...	526
*	...	...	...	15	11	7	4	4	1	1	...	...	...	...	...	...	...	...	43
In Puthur	654	799	1,314	1,649	1,761	1,913	1,380	1,110	703	381	173	83	21	8	7	...	...	...	11,956

* *N.B.*—These rows refer to dead dying trees as opposed to healthy trees in the rows above them. The differentiation was not made in all the enumerations.

APPENDIX VI—*cont.*

Details of Enumeration.

(In Diameter classes.)

Name of locality.		Below 1 inch.	2 inches.	3 inches.	4 inches	5 inches.	6 inches	7 inches.	8 inches.	9 inches.	10 inches.	11 inches.	12 inches.	13 inches.	14 inches.	15 inches.	16 inches.	17 inches	18 inches.	Total.
UNRESERVED FORESTS—*cont.*																				
In Patrakad	..	190	348	505	510	444	438	282	181	99	64	38	13	11	3	2	...	...	...	3,128
	*	...	...	...	1	...		2		...	...	...	...	...	...	...	...	...	...	3
In Malayalam	...	8	50	101	194	192	264	206	149	103	49	25	21	7	12	1	2	...	...	1,384
	*	...	...	...	19	16	21	12	9	7	3	1	...	...	...	...	..	...	...	88
Puliyur Unreserve ...	...	2,432	8,552	9,100	7,594	6,102	4,547	2,935	2,022	1,180	630	342	181	60	23	23	13	8	3	45,747
Kambugudi Unreserve	...	1,040	1,453	2,405	3,377	2,735	2,494	1,608	1,258	865	488	296	213	35	25	30	1	1	...	18,324
On the Yelagiri Hills ...	...	2,358	1,341	1,261	425	201	155	32	15	17	3	1	3	2	2	...	...		...	5,816
Mambakam Unreserve...	...	297	451	288	207	141	75	30	12	16	1	2	3	...	..	1	...	..	...	1,524
In Tenmalai Hills ...	..	3,599	7,010	5,606	4,656	3,704	2,980	2,152	1,550	1,081	631	440	296	100	75	47	10	9	2	33,948
Sivajama and Patta lands (Sandals belonging to Government).																				
In Tiruppattur Javadi	..	15	120	156	222	313	310	351	335	207	164	73	49	10	6	3	4	...	...	2,339
In Yelagiris	...	383	91	67	75	46	26	19	9	3	1	2	...	...	1	...	...	...	..	723
Total	...	13,809	25,822	28,527	26,209	22,224	18,613	12,417	9,026	5,647	3,016	1,741	1,059	277	165	121	35	19	6	168,733
	*	...	1	5	52	39	34	23	15	9	4	1	...	...	...	...	...	...	...	183
Grand total	...	133,415	147,234	144,774	113,330	85,100	66,399	40,364	27,645	17,161	8,496	5,426	2,898	949	567	322	127	45	46	794,298
	*	10	47	86	244	174	131	73	42	23	11	5	2	1	...	...	...	..	...	850

* *N.B.*—These rows refer to dead and dying trees as opposed to healthy trees in the rows above them. The differentiation was not made in all the enumerations.

APPENDIX VII.

I. *Calculation of probable annual yield from the minor crop,* i.e., *from trees that die before reaching maturity, in the Javadis.*

At * 8 inches in diameter there are 25 trees per 100 acres (*vide* graph No. 1).
At 15 do. 4 do. do.

From the analyses made in the preparation of this plan (*vide* Appendix No. IX) it is calculated that after it is ten years old the diameter growth of sandal averages ·21 inches per annum. (This result is borne out by measurements made from 72 trees felled during 1913–14 which showed an average of ·22 inches.)

Therefore it takes 33 years for trees to change from 8 to 15 inches diameter.

Therefore in 33 years 21 trees per 100 acres die.

Area of sandal forest in the Javadis 109,000 acres.

A tree 8 inches in diameter yields an average of 5 quarters of heartwood. (*Vide* graph No. 2.)

A tree 15 inches in diameter, yields an average of 25 quarters of heartwood. (*Vide* graph No. 2.)

As more trees die among the lower girth classes an average weight of 10 quarters of heartwood per tree may be adopted.

We thus get an *annual* yield from this minor crop of $\frac{109{,}000 \times 21 \times 10}{100 \times 33}$ quarters of heartwood.

This works out to approximately 7,000 quarters.

II. *Calculation of total average annual yield during and immediately after the felling period.*

There are now on the ground 4,954 trees of diameters varying from 12 to 18 inches and above (*vide* Enumerations in Appendix No. VI). By the end of the felling period (*i.e.,* in 18 years), allowing again for an increase of ·21 inches diameter per annum, these trees will be from 15 to 21 inches in diameter. It is however certain that all these will not survive. Assuming that 2,500 survive and 2,454 die we get the following calculations of yield for the felling period and for the felling cycle immediately following the conclusion of the felling period:—

(*a*) *For the Felling Period.*—During the felling period of 18 years 2,454 trees of diameters varying from 12 inches in the first year to 21 inches and above in the eighteenth year die and are extracted.

Assuming that the average is a tree 15 inches in diameter,—which yields 25 quarters of heartwood (*vide* graph No. 2)—, we get an average annual yield during the felling period of $\frac{2{,}454}{18} \times 25$ quarters = approximately 3,400 quarters.

But in addition to this there are the trees which are now below 12 inches in diameter which will die and be extracted during this felling period, and we may assume that this will be the same as the minor yield, calculated above, in calculation No. I, for the forest when in full bearing. This gives us a yield of 7,000 quarters, making in all an annual yield for the felling period prescribed for this Working Plan of 3,400 plus 7,000 = 10,400 quarters.

(*b*) *For the felling cycle immediately following the conclusion of the felling period.*—Again,—assuming that a tree 15 inches in diameter is mature,—within one felling cycle from the end of the felling period the present 11 inches trees will become mature. We can therefore reckon on the removal of all the 2,500 trees, which remain out of the 4,954 referred to above, during the first felling cycle of six years after the conclusion of the felling period. These trees will then be from 15 to 21 inches in diameter. Take an average tree as being 16 inches in diameter.

A 16-inches diameter tree yields an average of 28 quarters of heartwood. (*Vide* graph No. 2.) Therefore we get an average *annual* yield from the major crop of $\frac{2{,}500 \times 28}{6}$ quarters = approximately 11,500 quarters.

From the minor crop, the annual yield may be reckoned to be the same as from the minor crop when the forest is in full bearing as per calculation No. I, above, *i.e.,* 7,000 quarters.

This gives a total annual yield for this felling cycle of approximately 18,500 quarters of heartwood.

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* For trees below 8 inches in diameter there are not sufficient data on which to base a calculation, though trees of 4 inches diameter and even less do yield workable heartwood.

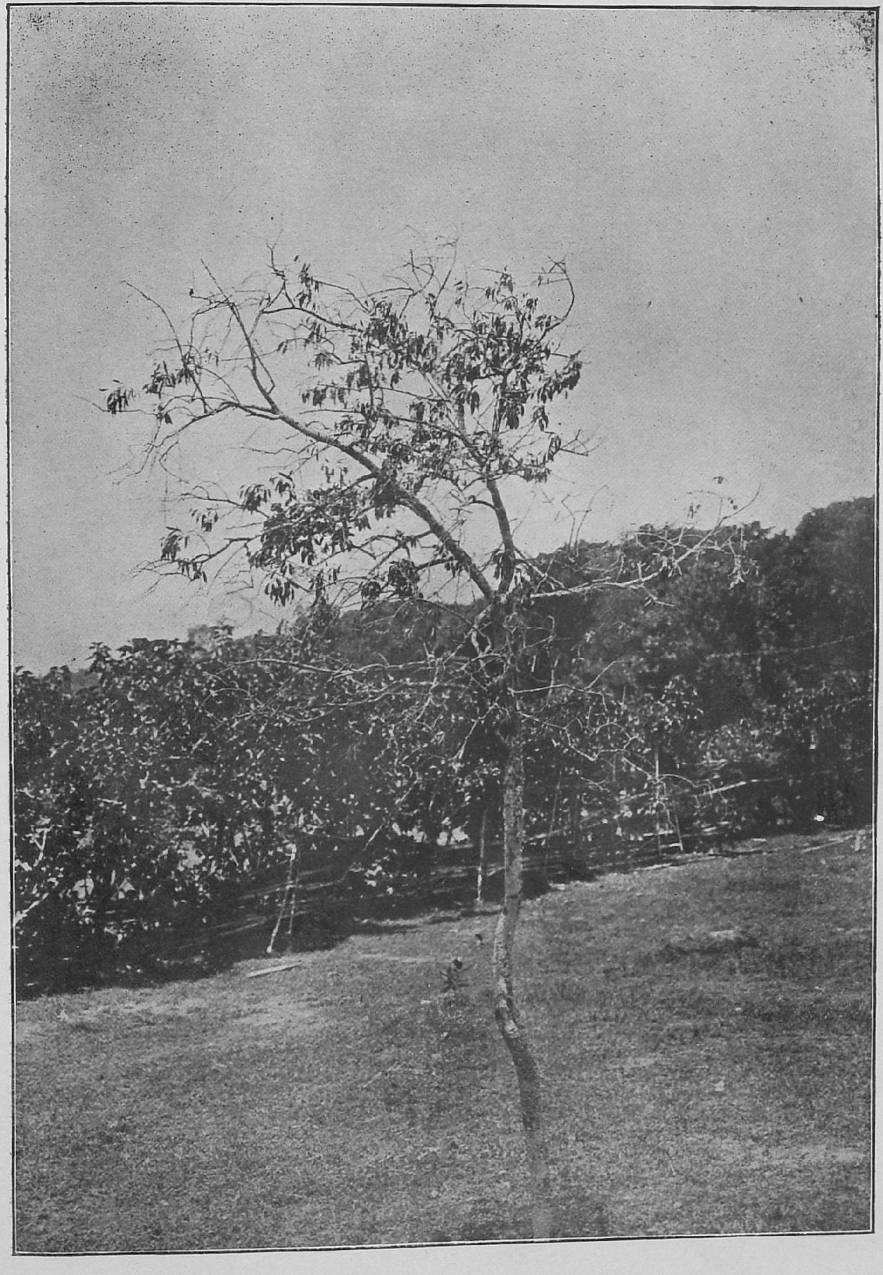
APPENDIX VIII.

PHOTOGRAPHS.

LEAVES OF A HEALTHY TREE. (PARA. 11 *f*.) (SANDAL.)

LEAVES OF A SPIKED TREE. (SANDAL.)

UNHEALTHY TREE. (PARA. 11*f*.) (SANDAL.)



HEALTHY TREE. (SANDAL.)

APPENDIX IX.

ANALYSES.

Date.—17th November 1913.

Locality.—Pakkumudaiyanur (Komattiyur enclosure).

Stem Analysis of a Sandalwood tree, with bole 16 feet in height in Komattiyur enclosure.

Height.—2,350 feet.

Girth at 4 feet from ground—3 feet 2 inches.

Soil.—Deep, red, clayey loam.

Radius of section 1 at foot of tree in inches.		Radius of section 2 at 2 feet from the ground in inches.		Radius of section 3 at 6 feet from the ground in inches.		Radius of section 4 at 10 feet from the ground in inches.		Radius of section 5 at 14 feet from the ground in inches.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark ...	5·8	With bark ...	5·9	With bark ..	5·0	With bark ...	4·5	With bark.	4·5
42	5·6	39	5·6	30	4·5	27	4·1	23	4·2
32	4·2	29 ...	4·0	20	3·2	17	2·3	13	2·2
22	2·6	19	2·2	10	1·5	7	·8	3	·2
12	1·1	9	·5	.....		......		......	
2	·2	......		......		......		......	

Volume at forty-two years.

Number of section.	Diameter in inches.	Basal area in sq. feet.	Length in feet.	Volume in c. feet.
1	11·2	·67	4	2·70
2	9·0	·44	4	1·77
3	8·2	·37	4	1·48
4	8·4	·38	4	1·52
Total ...	...	...	...	7·47

Volume at thirty-two years.

Number of section.	Diameter in inches.	Basal area in sq. feet.	Length in feet.	Volume in c. feet.
1	8·0	·34	4	1·36
2	6·4	·22	4	·88
3	5·6	·17	4	·68
4	4·4	·10	4	·40
Total ..	...	...	...	3·32

Volume at twenty-two years.

Number of section.	Diameter in inches.	Basal area in sq. feet.	Length in feet.	Volume in c. feet.
1	4·4	·10	4	·40
2	3·0	·04	4	·16
3	1·6	·01	4	·04
4	·4	·002	4	·008
Total ...	...	...	...	·608

Volume at twelve years.

Number of section.	Diameter in inches.	Basal area in sq. feet.	Length in feet.	Volume in c. feet.
1	1·0	·005	4	·02
...	...	...	...	...
..	...	...	...	...
...	...	...	...	...
Total ...	...	...	...	·02

Height.	Number of rings.	Age.
0	42	0
2	39	3
6	30	12
10	27	15
14	23	19

Date.—1st December 1913.

Locality.—Melput.

Analysis of Sapling stagheaded. Bole 16½ feet long, 15 inches girth at 4 feet diameter. Heartwood 2¾ inches at base. Age 14 years.

Soil.—Very good, rich red loam, 2 feet deep, thin gravelly.

Radius of section at base in inches.		Radius of section 2 at 2 feet from the ground in inches.		Radius of section 3 at 6 feet from the ground in inches.		Radius of section 4 at 10 feet from the ground in inches.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark ...	... 2·8	With bark ...	... 2·75	With bark ...	... 2·15	With bark ..	... 1·9
30	... 2·7	28	... 2·5	23	... 1·9	15	... 1·7
25	... 2·2	23	... 2·1	18	... 1·6	10	... 1·25
20	... 1·7	18	... 1·65	13	... 1·25	5	... ·7
15	... 1·15	13	... 1·2	8	... ·9	......	
10	... ·9	8	... ·7	3	... ·4	......	
5	... ·25	3	... ·25	......		......	

Volume at thirty years.

Number of section.	Diameter in inches.	Basal area in sq. ft.	Length in feet.	Volume in c. ft.
1	5·00	·14	4	·56
2	3·80	·08	4	·32
3	3·40	·06	4	·24
Total ...	...	...	...	1·12

Volume at twenty-five years.

Number of section.	Diameter in inches.	Basal area in sq. ft.	Length in feet.	Volume in c. ft.
1	4·2	·10	4	·40
2	3·2	·06	4	·24
3	2·5	·03	4	·12
Total ..	...	...	...	·76

Volume at twenty years.

Number of section.	Diameter in inches.	Basal area in sq. ft.	Length in feet.	Volume in c. ft.
1	3·3	·06	4	·24
2	2·5	·03	4	·12
3	1·4	·01	4	·04
Total ...	...	...	...	·40

Volume at fifteen years.

Number of section.	Diameter in inches.	Basal area in sq. ft.	Length in feet.	Volume in c. ft.
1	2·4	·03	4	·12
2	1·8	·02	4	·08
...	...	...	...	...
Total ...		...	...	·20

Volume at ten years.

Number of section.	Diameter in inches.	Basal area in sq. ft.	Length in feet.	Volume in c. ft.
1	1·4	·01	4	·04
2	·8	·003	4	·01
Total ...	...	...	...	·05

Volume at five years.

Number of section.	Diameter in inches.	Basal area in sq. ft.	Length in feet.	Volume in c. ft.
1	·5	·001	4	·004
...	...	...	...	...
Total ...	.	...	...	·004

Height.	Number of rings.	Age.
0	30	0
2	28	2
6	23	7
10	15	15

Date.—2nd December 1913.

Locality.—West of Erkampattu, near Sonaiparai in Tenmalai Reserved Forest.

Height of tree.—46 feet.

Height of bole.—36 feet.

Girth at 4 feet.—3 feet 8·6 inches.

Girth at base.—4 feet 9 inches.

Average diameter of heartwood at base.—1 foot 3 inches.

Analysis of a big sandalwood tree near Sonaiparai in Tenmalai Reserved Forest (just outside sandal coupes).

Elevation about 2,500 feet.

Aspect.—North-west.

Soil.—sandy black loam for 6 inches, then 1½ feet red clayey loam, below this compact gravel of disintegrated gneiss ?

Associates.—*Dendrocalamus Strictus* ; *Zizyphus xylopyra* (Kottai), *Terminalia chebula* (Kadukkai) ; *Zizyphus œnoplia* (Surai). Further away, *Anogeissus latifolia* (Namai).

Radius of section 1 at base in inches.		Radius of section 2 at 2 feet from the ground in inches		Radius of section 3 at 6 feet from the ground in inches.		Radius of secton 4 at 10 feet from the ground in inches.		Radius of section 5 at 14 feet from the ground in inches.		Radius of section 6 at 18 feet from the ground in inches.		Radius of section 7 at 22 feet from the ground in inches.		Radius of section 8 at 26 feet from the ground in inches.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark.	7·6	Bark	... 6·9	Bark	... 6·4	Bark	... 5·9	Bark	... 5·3	Rotten in centre.		Bark	... 4·3	Bark	... 3·6
55	... 7·3	48	... 6·3	42	... 6·2	37	... 5·2	27	... 4·8			22	... 3·8	18	... 3·1
45	... 5·8	38	... 5·5	32	... 4·7	27	... 4·3	17	... 3·2			12	... 1·9	8	... 1·2
35	... 4·1	28	... 4·6	22	... 3·2	17	2·8	7	... 1·2			2	... ·5	......	
25	... 2·6	18	... 2·9	12	... 1·5	7	... 1·2	......				......		......	
15	... 1·5	8	... 1·0	2	... ·2	......		......				...		......	
5	... ·5	......		......		...		......				......		......	

Volume at fifty-five years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1 ...	12·6	·87	4	3·48
2 ...	12·4	·84	4	3·36
3 ...	10·4	·59	4	2·36
4 ...	9·6	·50	4	2·00
5 ...	...	...	...	...
6 ...	7·6	·31	4	1·24
7 ...	6·2	·20	4	·80
Total ...	...	...	...	13·24

Volume at forty-five years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1 ...	11·0	·66	4	2·64
2 ...	9·4	·48	4	1·92
3 ...	8·6	·40	4	1·60
4 ...	6·4	·22	4	·88
5 ...	...		...	...
6 ...	3·8	·08	4	·32
7 ...	2·4	·03	4	·12
Total ...	...	...	...	7·48

Volume at thirty-five years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1 ...	9·2	·46	4	1·84
2 ...	6·4	·22	4	·88
3 ...	3·6	·07	4	·28
4 ...	2·4	·03	4	·12
5 ...	...	...	...	...
6 ...	1·0	·00	4	...
Total ...	...	...	...	3·12

Volume at twenty-five years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1 ...	5·8	·18	4	·72
2 ...	3·0	·05	4	·20
3 ...	2·4	·03	4	·12
...	...	...	...	...
...	...	...	...	...
...	...	...	...	...
Total ...	...	...	...	1·04

Volume at fifteen years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	2·0	·02	4	·08
2	·4	·00	4	...
Total ...	...	...	...	·08

Height.	Number of rings.	Age.
0	55	0
2	48	7
6	42	13
10	37	18
14	27	28
22	22	33
26	18	37

Date.—15th February 1914.

Locality.—In Reserved Forest just south-east of Kallaparai village which is in Mandaparai enclosure.

Elevation.—2,600 feet.

Aspect.—South-east.

Analysis of a sandalwood tree.

Girth at 4 feet.—31¾ inches.

Sandal plentiful and healthy.

Soil.—A good black loam, 1 foot 1½ inches deep.

Rocks.—Diorite ?

Height to fork.—28 feet.

Associates.—*Anogeissus latifolia*, *Erythroxylon monogynum*. Bamboo.

Radius of section 1 at foot of tree in inches.		Radius of section 2 at 2 feet from the ground in inches.		Radius of section 3 at 4 feet from the ground in inches.		Radius of section 4 at 6 feet from the ground in inches.		Radius of section 5 at 10 feet from the ground in inches.		Radius of section 6 at 14 feet from the ground in inches.		Radius of section 7 at 18 feet from the ground in inches.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
47 ...	5·5	42 ...	4·8	40 ...	4·25	37 ...	4·2	33 ...	4·2	27 ...	4·00	22 ...	3·5
37 ...	4·3	32 ...	3·4	30 ...	3·25	27 ...	3·1	23 ...	2·6	17 ...	2·25	12 ...	1·8
27 ...	3·2	22 ...	1·9	20 ...	2·25	17 ...	1·8	13 ...	1·2	7 ...	1·25	2	·25
17 ...	1·6	12 ...	·8	10 ...	1·1	7 ...	·6	3 ...	·3	......		......	
7 ...	·6	2 ...	·2	......		......		......		......		......	
Girth of heart-wood = 23″.		Girth of heart-wood = 21″.		......		......		......		......		......	

Volume at forty-seven years.					Volume at thirty-seven years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1 ...	9·6	·50	4	2·00	1 ...	6·8	·25	4	1·00
2 ...	8·4	·38	4	1·32	2 ...	6·2	·21	4	·84
3 ...	8·4	·38	4	1·32	3 ...	5·2	·15	4	·60
4 ...	...	...	...	...	4 ...	...	...	...	...
5 ..	7·0	·27	4	1·08	5 ...	3·6	·07	4	·28
Total ...	...	...	...	5·72	Total ...	...	...	...	2·72

Volume at twenty-seven years.					Volume at seventeen years.				
1 ...	3·8	·08	4	·32	1 ...	1·6	·01	4	·04
2 ...	3·6	·07	4	·28	2 ...	1·2	·01	4	·04
3 ...	2·4	·03	4	·12	3 ...	·6	·00	4	...
4 ...	...	...	..	...	...	...	...	...	...
5 ...	·50	·00	4	...	...	...	...	...	...
Total ...	...	...	...	·72	Total ...	...	...	..	·08

Volume at seven years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	·4	·00	4	...

Height.	Number of rings.	Age.
0	47	0
2	42	5
6	37	10
10	33	14
18	22	25

Date.—15th February 1914.

Locality.—Just inside the Mandaparai enclosure.

Otherwise Elevation, Soil, Aspect, etc.—same as analysis No. 4.

Analysis of a sandalwood tree—28 inches in girth at breast height.

Radius of section 1 at foot of tree in inches.		Radius of section 2 at 2 feet from the ground in inches.		Radius of section 3 at 4 feet from the ground in inches.		Radius of section 4 at 6 feet from the ground in inches.		Radius of section 5 at 10 feet from the ground in inches.		Radius of section 6 at 14 feet from the ground in inches.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
40	5·25	36	4·4	32	4·0	30	4·0	27	3·75	?	3·5
30	4·0	26	3·25	22	2·4	20	2·6	17	2·4	......	
20	2·9	16	2·0	12	·9	10	1·2	7	1·15	......	
10	1·4	6	·65	2	·25	......		......		......	

Volume at forty years.					Volume at thirty years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	8·8	·42	4	1·78	1	6·5	·23	4	·92
2	8·0	·35	4	1·40	2	5·2	·15	4	·60
3	7·5	·30	4	1·20	3	4·8	·12	4	·48
4	7·0	·27	4	1·08	...	...	...	...	...
Total ...	...	...	...	5·46	Total ...	...	...	...	2·00
Volume at twenty years.					Volume at ten years.				
1	4·0	·09	4	·36	1	1·3	·01	4	·04
2	2·4	·03	4	·12	...	...	...	...	...
3	2·3	·03	4	·12	...	...	...	...	...
Total ...	...	...	...	·60					

Height.	Number of rings.	Age.
0	40	0
2	36	4
6	30	10
10	27	13

Date.—16th February 1914.

Locality.—Kaliammankoil, Veerappanoor Reserve, North-west of Mandaparai,

Girth at base.—43 inches, *at breast height* 36 inches.

Stem analysis of a sandalwood tree near Mandaparai, Veerappanoor Reserve.

Height of bole.—15 feet.

Aspect.—North-west.

Gradient.—5°.

Elevation.—2,600 feet.

Radius of section 1 at foot of tree in inches.		Radius of section 2 at 2 feet from the base.		Radius of section 3 at 6 feet from the base.		Radius of section 4 at 10 feet from the base.		Radius of section 5 at 14 feet from the base.		Section at 4 feet from the base at breast height.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
50	6·6	48	5·5	42	5·1	39	4·8	37	4·7	With bark.	5·4
40	5·0	38	4·8	32	4·1	29	3·9	27	3·8	44	5·1
30	4·1	28	3·6	22	2·9	19	2·8	17	2·8	34	4·2
20	2·6	18	2·4	12	1·4	9	1·2	7	·9	24	3·0
10	1·3	8	1·0	2	·4	......		......		14	1·8
Heartwood 33.	4·4	33	4·0	29	3·7	24	3·5	23	3·4	4	·5
										Heartwood 30.	3·7

Volume at fifty years.					Volume at forty years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	11·0	·66	4	2·64	1	9·6	·50	4	2·00
2	10·2	·57	4	2·28	2	8·2	·37	4	1·48
3	9·6	·50	4	2·00	3	7·8	·33	4	1·32
4	9·4	·48	4	1·92	4	7·6	·31	4	1·24
Total ...	...	...	...	8·84	Total ...	...	...		6·04

Volume at thirty years.					Volume at twenty years.				
1	7·2	·28	4	1·12	1	4·8	·12	4	·48
2	5·8	·18	4	·72	2	2·8	·04	4	·16
3	5·6	·17	4	·68	3	2·4	·03	4	·12
4	5·6	·17	4	·68	4	1·8	·02	4	·08
Total ...	...	...	...	3·20	Total ...	...	..	...	·84

Volume at ten years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	2·0	·02	4	·08
2	·8	...	...	...

Height.	Number of rings.	Age.
0	50	...
2	48	2
6	42	8
10	39	11
14	37	13

Locality.—Kambugudi Unreserves.
Aspect.—West.
Elevation.—3,689 feet.
Soil.—Reddish loam mixed with small boulders.
Girth at 4 feet—36½ inches.

Section at base.		Radius of section 2 at 2 feet from the ground.		Radius of section 3 at 6 feet from the ground.		Radius of section at 4 feet from the base.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark ..	6·0	With bark.	5·8	With bark	5·1	With bark	5·2
58	5·9	55	5·6	49 .. .	4·9	52	5·0
48	4·8	45	4·8	39	4·0	42	3·9
38	4·0	35	3·8	29	2·9	32 ...	2·8
28	3·1	25	2·8	19 ..	2·1	22 ...	2·1
18	2·1	15	1·5	9	1·0	12 ...	1·1
8	0·9	5	0·5	Heartwood 31	3·2	2	0·2
Heartwood 41	4·5	Heartwood 37 ...	4·1			Heartwood 39 ...	3·5

Volume at fifty-eight years.					Volume at forty-eight years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	11·2	·68	4	2·72	1	9·6	·50	4	2·00
2	9·8	·52	4	2·08	2	8·0	·35	4	1·46
Total ...	...	...	..	4·80	Total ...	...	...	...	3·40

Volume at thirty-eight years.					Volume at twenty-eight years				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet	Volume in cubic feet.
1	7·6	·31	4	1·24	1	5·6	·17	4	·68
2	5·8	·18	4	·72	2	4·2	·10	4	·40
Total ...	...	...	...	1·96	Total ...	...	...	...	1·08
Volume at eighteen years.					**Volume at eight years.**				
1	3·0	·05	4	·20	1	1	...	...	...
2	2·0	·02	4	·08	...	...	...	...	...
Total ...	...	...		28					

Height.	Number of rings.	Age.
...	58	...
2	55	3
4	52	6
6	49	10

Locality.—Kambugudi Unreserve.
Aspect.—East.
Elevation. 3,600 feet.
Soil.—Red loam, stony.
Girth at 4 feet—37 inches.

Radius of section at base.		Radius of section 2 at 2 feet from the base.		Radius of section 3 at 6 feet from the base.		Radius of section 4 at 10 feet from the base.		Radius of section 5 at 14 feet from the base.		Radius of section at 4 feet from the base.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark	6·1	With bark	5·5	With bark	5·0	With bark ...	5·0	With bark ...	4·6	With bark ...	5·4
58	5·9	52	5·2	46	4·8	45 ...	4·8	44 ...	4·5	47 ...	5·1
48	5·0	42	4·6	36	4·0	35 ...	3·9	34 ..	3·8	37 ...	4·1
38	4·1	32	3·8	26	2·8	25 ...	2·9	24 ..	3·1	27 ...	2·8
28	3·0	22	2·5	16	1·9	15 ...	1·8	14 ...	1·9	17 ...	1·9
18	1·8	12	1·4	6	·8	5	·6	4 ...	·5	7 ...	·6
8	·8	2	·3	...		......		... ..		Heartwood 36	4·0
Heartwood 41	4·2	Heartwood 37	4·0	Heartwood 29	3·7	Heartwood 33	3·7	Heartwood 29	3·4		

Volume at fifty-eight years.					Volume at forty-eight years.				
Number of section.	Diameter in inches.	Basel area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basel area in square feet.	Length in feet	Volume in cubic feet.
1	10·4	·59	4	2·36	1	9·2	·46	4	1·84
2	9·6	·50	4	2·00	2	8·0	·35	4	1·40
3	9·6	·50	4	2·00	3	7·8	·33	4	1·32
4	9·0	·44	4	1·76	4	7·6	·31	4	1·24
Total ...		...	...	8·12	Total ...	...	...	..	5·80

Volume at thirty-eight years.					Volume at twenty-eight years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	7·6	·31	4	1·24	1	5·0	·13	4	·52
2	5·6	17	4	[illegible]	2	3·8	07	4	28
3	5·8	·18	4	·72	3	3·6	·07	4	·28
4	6·2	·21	4	·84	4	3·8	·07	4	·28
Total ...	...		...	3·48	Total ...	...	...	..	1·36

Volume at eighteen years.					Volume at eight years.				
1	2·8	·04	4	·16	1	·6	..	..	...
2	1·6	·01	4	·04	...	...	...	...	...
3	1·2	·00	4	..	...	..	...	...	...
4	1·0	·00	4	...	...	...	.	...	
Total ...	...	...	...	·20					

Height.	Number of rings.	Age.
..	58	...
2	52	6
4	47	11
6	46	12
10	45	13
14	44	14

Locality.—Kambugudi Unreserve near Nadur.
Aspect.—West.
Elevation.—3,500 feet.
Soil.—Blackish deep loam.
Girth at 4 feet—36 inches.

Radius of section at base.		Radius of section 2 at 2 feet from the base.		Radius of section 3 at 6 feet from the base.		Radius of section 4 at 10 feet from the base.		Radius at 4 feet from the base.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark ...	6·1	With bark ..	5·3	With bark ...	5·1	With bark	5·0	With bark ...	5.1
51	5·8	44	5·1	41 ...	4·8	39	4·8	42 ...	5·0
41	5·0	34	4·0	31 ...	3·9	29	3·7	32 ...	3·9
31	3·8	24 ...	2·9	21	2·8	19	2·6	22 ...	2·8
21	2·7	14 ...	1·6	11	1 5	9 ...	1·2	12 ...	1·5
11	1 4	4	·3	1 ..	·2			2 ...	·3
1	·1	Heartwood 30	3·5	Heartwood 22	2·9	Heartwood 28	3 6	Heartwood 32	3·9
Heartwood 32 ..	4·2								

Volume at fifty-one years.					Volume at forty-one years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	10·2	[illegible]	4	2 24	1	8	·35	4	1·40
2	9·6	·50	4	2·00	2	7 8	·33	4	1·32
3	9·6	·50	4	2·00	3	7·4	30	4	1·20
Total ...	...	...	...	6·24	Total ...	..	...	...	3·92

Volume at thirty-one years.					Volume at twenty-one years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	5·8	·18	4	·72	1	3·2	·05	4	·20
2	5·6	·17	4	·68	2	3	·05	4	·20
3	5·2	·15	4	·60	3	2·4	·03	4	·12
Total ...	...	...	...	2·00	otal ...	..	...	...	·52

Volume at eleven years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	·6	·003	4	·01
2	·4	·002	4	·00
Total ...	...	...	...	·01

Height.	Number of rings.	Age.
...	51	...
2	44	7
4	42	9
6	41	10
10	39	12

Locality.—Kambugudi Unreserve.
Aspect.—West.
Elevation.—3,400 feet.
Soil.—Deep red loam.
Girth at 4 feet—36 inches.

Radius of section at base.		Radius of section 2 at 2 feet from the base.		Radius of section 3 at 6 feet from the base.		Radius of section at 4 feet from the base.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark ...	... 6·0					With bark ...	... 5·5
56 ...	... 5·8	54 ..	... 5·3	51 ...	... 5·1	53 ...	... 5·2
46 ...	... 4·9	44 ...	... 4·5	41 ...	... 4·4	43 ...	... 4·4
36 ...	... 3·7	34 ...	3·6	31 ...	... 3·5	33 ...	... 3·6
26 ...	... 2·9	24 ..	2·7	21 ...	... 2·7	23 ...	... 2·7
16 ...	... 1·7	14 ...	... 1·5	11 ...	1·4	13 ...	... 1·5
6 ..	... ·6	4 ..	... ·5	1 ...	... ·2	3 ...	... ·3
Heartwood 38	... 3·9	Heartwood 38	... 3·8	Heartwood 33...	... 3·6	Heartwood 35	... 3·7

Volume at fifty-six years.					Volume at forty-six years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	10·6	·61	4	2·44	1	9·0	·44	4	1·76
2	10·1	·55	4	2·20	2	8·8	·42	4	1·68
Total	..	...	...	4·64	Total ..	...	...	...	3·44

Volume at thirty-six years.					Volume at twenty-six years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	7·2	·28	4	1·12	1	5·4	·16	4	·64
2	7·0	·26	4	1·04	2	5·4	·16	4	·64
Total ...	...	...	...	2·16	Total ...	...	...	...	1·28
Volume at sixteen years.					Volume at six years.				
1	3·0	·05	4	·20	1	1·0	·01	4	·04
2	2·8	·04	4	·16	2	0·4	...	4	...
Total	...	...	...	3·6					

Height.	Number of rings.	Age.
...	56	...
2	54	2
4	53	3
6	51	5

Locality.—Kambugudi Unreserve.
Aspect.—West.
Elevation.—3,700 feet.
Soil.—Reddish loam-deep.
Girth at 4 feet from the base.—36 inches.

Radius of section at base.		Radius of section 2 at 2 feet from the base.		Radius of section 3 at 6 feet from the base.	Radius of section 4 at 10 feet from the base.	Radius at 4 feet from the base.	
AGE.	RADIUS.	AGE.	RADIUS.			AGE.	RADIUS.
With bark ...	6·5	With bark ...	5·4	...	...	With bark	5·3
55 ...	6·2	53 ...	5·2	...	...	44 ...	4·9
45 ...	5·1	43 ...	4·2	...	...	34 ...	3·6
35 ...	4·0	33 ...	3·4	..	..	24 ...	2·8
25 ...	3·1	23 ...	2·6	...	...	14 ...	1·8
15 ...	1·8	13 ...	1·3	.	...	4 ...	0·5
5 .	0·5	3 ...	0·3	...	...	......	
Heartwood 34...	3·9	.....		...	...	Heartwood 30.	3·2

Volume at fifty-five years.					Volume at forty-five years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1 ...	10·4	·59	4	2·36	1 ...	8·4	·38	4	1·52
Volume at thirty-five years.					Volume at twenty-five years.				
1 ...	6·8	·25	4	1·00	1 ...	5·2	·15	4	·60.

Volume at fifteen years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1 ...	2·6	·03	4	·12

Locality.—Mambakkam Reserved Forest near Molali.
Aspect.—South.
Elevation.—2,800 feet.
Soil.—Sandy loam.
Girth at 4 feet from the base.—36 inches.

Radius of section 1 at base.		Radius of section 2 at 2 feet from the base.		Radius of section 3 at 6 feet from the base.		Radius of section at 4 feet from the base.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark ...	... 6·3	With bark ...	... 5·8	With bark ...	... 5·0	With bark ...	... 5·1
57 ...	... 6·1	54 ...	... 5·6	43 ...	... 4·7	46 ...	... 4·9
47 ...	... 5·5	44 ...	... 4·8	33 ...	... 4·0	36 ...	... 4·3
37 ...	... 4·3	34 ...	... 4·0	23 ...	... 2·5	26 ...	... 3·1
27 ...	... 3·1	24 ...	... 3·0	13 ...	... 1·5	16 ...	... 2·1
17 ...	... 2·1	14 ...	... 2·2	3 ...	... 0·3	6 ...	... 0·7
7 ...	... 0·9	4 ...	... 0·6	......		......	
Heartwood 32	... 3·5	Heartwood 30	... 3·4	Heartwood 23	... 2·5	Heartwood 28	... 3·2

Volume at fifty-seven years.					Volume at forty-seven years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1 ...	11·2	·68	4	2·72	1 ...	9·6	·50	4	2·00
2 ...	9·4	·48	4	1·92	2 ...	8·0	·35	4	1·40
Total ...	...	...	...	4·64	Total ...	...	...	...	3·40
Volume at thirty-seven years.					**Volume at twenty-seven years.**				
1 ...	8·0	·35	4	1·40	1 ...	6	·19	4	·76
2 ...	5·0	·13	4	0·52	2 ...	3	·05	4	·20
Total ...	...	...	...	1·92	Total ...	...	...	...	·96
Volume at seventeen years.					**Volume at seven years.**				
1 ...	4·4	·10	4	·40	1 ...	1·2	·008	4	·03
2 ...	0·6	...	...	...	...	...	...	...	...

Height.	Number of rings.	Age.
...	57	...
2	54	3
4	46	11
6	43	14

Locality.—Kambugudi Unreserve.
Aspect.—West.
Elevation.—3,600 feet.
Soil.—Reddish loam with small boulders.
Girth at 4 feet from the base.—30 inches.

Radius of section at base.		Radius of section 2 at 2 feet from the ground.		Radius of section 3 at 6 feet from the ground.		Radius of section 4 at 16 feet from the ground.		Radius of section at 4 feet from the ground.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark ...	5·7	With bark ...	5·4	With bark ...	4·4	With bark	4·3	With bark	4·8
51 ...	5·2	49 ...	5·1	43 ..	4·2	41 ...	4·0	45 ..	4·6
41 ...	4·5	39 ...	4·4	33 ...	3·6	31 ...	3·1	35 ...	3·7
31 ...	3·5	29 ...	3·4	23 ...	2·5	21 ...	2·2	25 ...	2·5
21 ...	2·4	19 ...	2·3	13 ...	1·4	11 ...	1·4	15 .	1·6
11 ...	1·1	9 ...	1·0	3 ...	0·4	1 ...	0·2	5 ...	0·6
1 ...	0·1	......		......		......		......	
Heartwood 32	3·6	Heartwood 28	3·3	Heartwood 28	2·8	Heartwood 28	2·8	Heartwood 29	2·9

Volume at fifty-one years.					Volume at forty-one years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1 ...	10·2	·56	4	2·24	1 ...	8·8	·42	4	1·68
2 ...	8·4	·38	4	1·52	2 ...	7·2	·28	4	1·12
3 ...	8·0	·35	4	1·40	3 ...	6·2	·21	4	·84
Total ...	...	...	...	5·16	Total ...	...	...	...	3·64

Volume at thirty-one years.					Volume at twenty-one years.				
1 ...	6·8	·25	4	1·00	1 ...	4·6	·11	4	·44
2 ...	5·0	·13	4	0·52	2 ...	2·8	·04	4	·16
3 ...	4·4	·10	4	0·40	3 ..	2·8	·04	4	·16
Total ...	...	...	...	1·92	Total ...	...	...	...	·76

Volume at eleven years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	2·0	·02	4	·08
2	0·8	·003	4	·01
3	0·4		4	...
Total ...	...	...	...	·09

Height.	Number of rings.	Age.
...	51	...
2	49	2
4	45	6
6	43	8
10	41	10

Locality.—Kambugudi Unreserve.
Aspect.—West.
Elevation.—3,650 feet.
Soil.—Shallow, rocky, loam.
Girth at 4 feet from the base.—29½ inches.

Radius of section 1 at base.		Radius of section 2 at 2 feet from the ground.		Radius of section 3 at 6 feet from the ground.		Radius at 4 feet from the ground.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark ...	... 5·2	With bark ...	... 4·6	......		With bark ...	... 4·5
49 ...	... 4·9	47 ...	4·3	42	... 4·0	44 ...	... 4·1
39 ...	... 4·1	37 ...	... 3·6	32 ...	... 3·3	34 ...	... 3·4
29 ...	... 3·3	27 ...	... 2·7	22 ...	... 2·3	24 ...	2·3
19 ...	... 2·0	17 ...	... 1·8	12 ...	... 1·4	14 ...	... 1·3
9 ...	... 0·8	7	... 0·5	2 ...	... 0·3	4 ...	... 0·4
Heartwood 29	... 3·3	Heartwood 33	... 2·9			Heartwood 27	... 2·5

Volume at forty-nine years.					Volume at thirty-nine years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	8·6	·40	4	1·60	1	7·2	·28	4	1·12
2	8·0	·35	4	1·40	2	6·6	·17	4	0·68
Total ...	...	...	..	3·00	Total ...	...	...	...	1·80

Volume at twenty-nine years.					Volume at nineteen years.				
1	5·4	·16	4	·64	1	3·6	·07	4	·28
2	4·6	·11	4	·44	2	2·8	·04	4	·16
Total ...	...	...	...	1·08	Total ...	...	...	...	·44

Volume at nine years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	1·0	·005	4	·02
2	0·6	·002	4	·01
Total ...	...	...	...	·03

Height.	Number of rings.	Years
...	49	...
2	47	2
4	44	5
6	42	7

Locality.—Kambugudi Unreserve.
Aspect.—West.
Elevation.—3,500 feet.
Soil.—Stony blackish loam.
Girth at 4 feet from the base—29 inches.

Radius of section 1 at base.		Radius of section 2 at 2 feet from the ground.		Radius of section 3 at 6 feet from the ground.		Radius of section 4 at 10 feet from the ground.		Radius of section at 4 feet from the ground.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark ...	5·4	With bark ...	4·6	With bark ...	4·0	With bark ...	3·9	With bark ...	4·3
46 ...	5·1	44 ...	4·2	36 ...	3·7	34 ...	3·7	42 ...	4·2
36 ...	4·7	34 ...	3·3	26 ...	3·1	24 ...	3·1	32 ...	3·4
26 ...	2·9	24 ..	2·6	16 ...	2·1	14 ...	2·5	22 ...	2·4
16 ...	1·4	14 ...	1·4	6 ...	0·9	4 ...	0·6	12 ...	1·4
6 ...	0·5	4 ...	0·5	......		......		2 ...	0·2
Heartwood 28.	3·8	Heartwood 28.	3·0	Heartwood 22.	2·8	Heartwood 17.	2·8	Heartwood 28.	3·0
Very eccentric.									

Volume at forty-six years.					Volume at thirty-six years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	8·4	·38	4	1·52	1	6·6	·23	4	1·02
2	7·4	·29	4	1·16	2	6·2	·21	4	0·84
3	7·4	·29	4	1·16	3	6·2	·21	4	0·84
Total ...	...	...	...	3·84	Total ...	...	...	...	2·70
Volume at twenty-six years.					**Volume at sixteen years.**				
1	5·2	·14	4	·56	1	2·8	·04	4	·16
2	4·2	·09	4	·36	2	1·8	·01	4	·04
3	5·0	·13	4	·52	3	1·2	·007	4	·02
Total ...	...	...	...	1·44	Total ...	...	...	...	·22

Volume at six years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	1	·005	4	·02
Total ...	...	...	...	...

Height.	Number of rings.	Years.
...	46	...
2	44	2
4	42	4
6	36	10
10	34	12

Locality.—Kambugudi Unreserve.
Aspect.—West.
Elevation.—3,650 feet.
Soil.—Stony soil.
Girth at 4 feet from the base—29 inches.

Radius of section 1 at base.		Radius of section 2 at 2 feet from the base.		Radius of section 3 at 6 feet from the base.		Radius of section at 4 feet from the ground.
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	
With bark ...	5·4	With bark ...	4·7	With bark ...	3·9	Hollow.
46 ...	5·0	43 ...	4·4	38 ...	3·7	
36 ...	4·1	33 ...	3·3	28 ...	2·6	
26 ...	2·9	23 ...	2·3	18 ...	1·7	
16 ...	1·6	13 ...	1·2	8 ...	0·9	
6 ...	0·5	3 ...	0·3	......		
Heartwood 29.	3·2	Heartwood 32.	3·2	Heartwood 24...	2·4	

Volume at forty-six years.					Volume at thirty-six years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.	Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	8·8	·42	4	1·68	1	6·6	·23	4	·92
2	7·4	·29	4	1·16	2	5·2	·14	4	·56
Total ...	...	...	...	2·84	Total ...	...	...	...	1·48

Volume at twenty six years.					Volume at sixteen years.				
1	4·6	·11	4	·44	1	2·4	·03	4	·12
2	3·4	·06	4	·24	2	1·8	·01	4	·04
Total ...	...	...	...	·68	Total ...	...	...	...	·16

Volume at six years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
'	·6	·002	4	...

Height	Number of rings.	Age.
...	46	...
2	43	3
6	38	8

Locality.—Kambugudi Unreserve.
Aspect.—West.
Elevation.—3,600 feet.
Soil.—Stony loam.
Girth at 4 feet from the base—30 inches.

Radius of section 1 at base.		Radius of section 2 at 2 feet from the ground.		Radius of section 3 at 6 feet from the base.		Radius of section 4 at 10 feet from the base.		Radius of section 5 at 14 feet from the base.		Radius of section 6 at 18 feet from the base.		Radius of section at 4 feet from the ground.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark	5·5	With bark	5·1	With bark	4·6	With bark	4·4	With bark		With bark	4·0	With bark.	4·7
49 ...	5·1	48 ...	4·9	45 ...	4·5	40 ...	4·2			36 ...	3·8	47 ...	4·6
39 ...	4·4	38 ...	4·0	35 ...	3·8	30 ...	3·3			26 ...	3·0	37 ...	3·9
29 ...	3·1	28 ..	3·0	25 ...	2·8	20 ...	2·3	Hollow.		16 ...	2·1	27 ...	2·8
19 ...	1·8	18 ..	1·9	15 ...	1·7	10 ...	1·1			6 ...	0·7	17 ...	1·7
9 ..	0·9	8 ...	0·7	5 ...	0·5	......				......		7 ...	0·8
Heartwood		Heartwood		Heartwood		Heartwood				Heartwood			
35.	3·7	34.	3·5	29.	3·1	24	2·7			21.	2·6		

Volume at forty-nine years.

Number of sections.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	9·8	·52	4	2·08
2	9·0	·44	4	1·76
3	8·4	·38	4	1·42
4	...	...	...	...
5	7·6	·31	4	1·24
Total ...	...	...	...	6·50

Height.	Number of rings.	Age.
...	49	...
2	48	1
4	47	2
6	45	4
10	40	9
18	36	13

Locality.—Kambugudi Unreserve.
Aspect.—West.
Elevation.—3,650 feet.
Soil.—Stony red loam.
Girth at 4 feet from the base—29 inches.

Radius of section at base.		Radius of section 2 at 2 feet from the ground.		Radius of section 3 at 6 feet from the ground.		Radius of section 4 at 10 feet from the ground.		Radius of section at 4 feet from the ground.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark ...	5·5	With bark ...	4·8	With bark ...	4·5	With bark ...	3·8	With bark	4·5
50 ...	5·4	49 ...	4·5	45 ...	4·3	38 ...	3·5	48	4·3
40 ...	5·0	39 ...	3·8	35 ...	3·6	28 ...	2·8	38	3·7
30 ...	4·2	29 ...	2·2	25 ...	2·9	18 ...	1·8	28	3·0
20 ...	3·8	19 ...	1·7	15 ...	1·9	8 ...	0·8	18	2·1
10 ...	0·9	9 ...	0·8	5 ...	0·7	......		8	1·2
Heartwood ... Eccentric		Heartwood 36.	3·5	Heartwood 28 ..	3·2	Heartwood 27 ...	2·7	Heartwood 30.	3·3

Volume at fifty years.

Number of sections.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	9·0	·44	4	1·76
2	8·6	·40	4	1·60
3	7·0	·26	4	1·14
Total ...	...	...	...	4·50

Volume at forty years.

Number of sections.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	7·6	·31	4	1·24
2	7·2	·28	4	1·12
3	5·6	·17	4	0·68
Total ...	...	...	...	3·04

Volume at thirty years.

Number of sections.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	4·4	·10	4	·40
2	5·8	·18	4	·72
3	3·6	·07	4	·28
Total ...	...	...	...	1·40

Volume at twenty years.

Number of sections.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	3·4	·06	4	·24
2	3·8	·08	4	·32
3	1·6	·01	4	·04
Total ...	...	...	...	·60

Volume at ten years.

Number of sections.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	1·6	·01	4	·04
2	1·4	·01	4	04
Total ...	...	...	...	·08

Height.	Number of rings.	Age.
...	50	...
2	49	1
4	48	2
6	45	5
10	38	12

Tree analysis of Sandal at Kilthattiapattu.
Soil.—Very deep—clayey reddish loam.
Girth—at 4 feet 7½ inches.
Weight of the tree including sapwood.—155 qrs. 25 lb. 6 oz.
Aspect.—West.
Gradient.—Very gentle almost flat.

Section at base.		Radius of section 2 at 2 feet from the ground.		Radius of section 3 at 6 feet from the ground.		Radius of section 4 at 10 feet from the ground.		Radius of section 5 at 14 feet from the ground.		Radius of section 6 at 18 feet from the ground.		Radius of section 7 at 22 feet from the ground.		Radius of section 8 at 26 feet from the ground.	
AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.	AGE.	RADIUS.
With bark ...	10·8	*													
100 ...	10·6	98	10·5	89 ...	9·6	86 ...	9·3	82 ...	9·1	77 ...	6·4	69 ...	5·5	56 ...	3·7
90 ...	9·8	88 .	9·6	79 ...	8·8	76 ...	8·7	72 ...	8·3	67 ...	5·8	59 ...	4·9	46 ...	3·2
80 ...	8·8	78 ...	8·7	69 ...	8·3	66 ...	8·1	62 ...	7·5	57	5·2	49 ..	4·2	36 ...	2·7
70 ...	7·8	68 .	7·9	59 ...	7·4	56 ...	7·2	52	6·8	47 ...	4·5	39 ...	3·4	26 ...	1·9
60 ...	6·8	58	6·6	49 ...	6·2	46 ...	6·0	42 ...	5·4	37 ...	3·7	29 ...	2·8	16 ...	1·3
50 ...	5·9	48 ...	5·7	39 ...	5·1	36 ...	4·9	32 ..	3·8	27 ...	2·9	19 .	1·7	6 ..	·4
40 ...	4·8	38 ..	4·6	29 ...	3·6	26 ...	3·3	22 ...	2·5	17 ..	2·0	9 ...	8		
30 ...	3·4	28 ...	3·2	19 ...	2·1	16 ...	1·8	12 ...	1·4	7 ...	·9				
20 ...	2·4	18 ...	2·1	9 ..	1·1	6 ...	·9	2 ...	·3						
10 ...	1·1	8													

* The trunk was hollow and the column has therefore been computed.

Volume at hundred years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	21	2·40	4	9·60
2	19·2	2·01	4	8·04
3	18·6	1·88	4	7·52
4	18·2	1·80	4	7·20
5	12·8	·89	4	3·56
Total ...	...	...	...	35·92

Volume at ninety years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	19·2	2·01	4	8·04
2	17·6	1·69	4	6·76
3	17·4	1·65	4	6·60
4	16·6	1·50	4	6·00
5	11·6	·73	4	2·92
Total ...	...	...	...	30·32

Volume at eighty years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	17·4	1·65	4	6·60
2	16·6	1·50	4	6·00
3	16·2	1·43	4	5·72
4	15·0	1·23	4	4·92
5	10·4	·59	4	2·36
Total ...	...	...	...	25·60

Volume at seventy years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	15·8	1·36	4	5·44
2	14·8	1·19	4	4·76
3	14·4	1·13	4	4·52
4	13·6	1·01	4	4·04
5	9·0	·44	4	1·76
Total ...	..	...	...	20·52

Volume at sixty years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	13·2	·95	4	3·80
2	12·4	·84	4	3·36
3	12·0	·78	4	3·12
4	10·8	·63	4	2·52
5	7·4	·29	4	1·16
Total ...	...	...	...	13·96

Volume at fifty years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	11·4	·71	4	2·84
2	10·2	·56	4	2·24
3	9·8	·52	4	2·08
4	7·6	·31	4	1·24
5	5·8	·18	4	·72
Total ...	...	...	...	9·12

Volume at forty years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	9·2	·46	4	1·84
2	7·2	·28	4	1·12
3	6·6	·23	4	·92
4	5·0	·13	4	·52
5	4·0	08	4	·32
Total ...	...	...	...	4·72

Volume at thirty years.

Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	6·4	·22	4	·88
2	4·2	·09	4	·36
3	3·6	·07	4	·28
4	2·8	·04	4	·16
5	1·8	·01	4	·04
Total ...	...	..	...	1·72

Volume at twenty years.				
Number of section.	Diameter in inches.	Basal area in square feet.	Length in feet.	Volume in cubic feet.
1	4·2	·09	4	·36
2	2·2	·02	4	·08
3	1·8	·01	4	·04
4	...	...	..	...
5	...	...	...	...
Total ...		...	...	·48

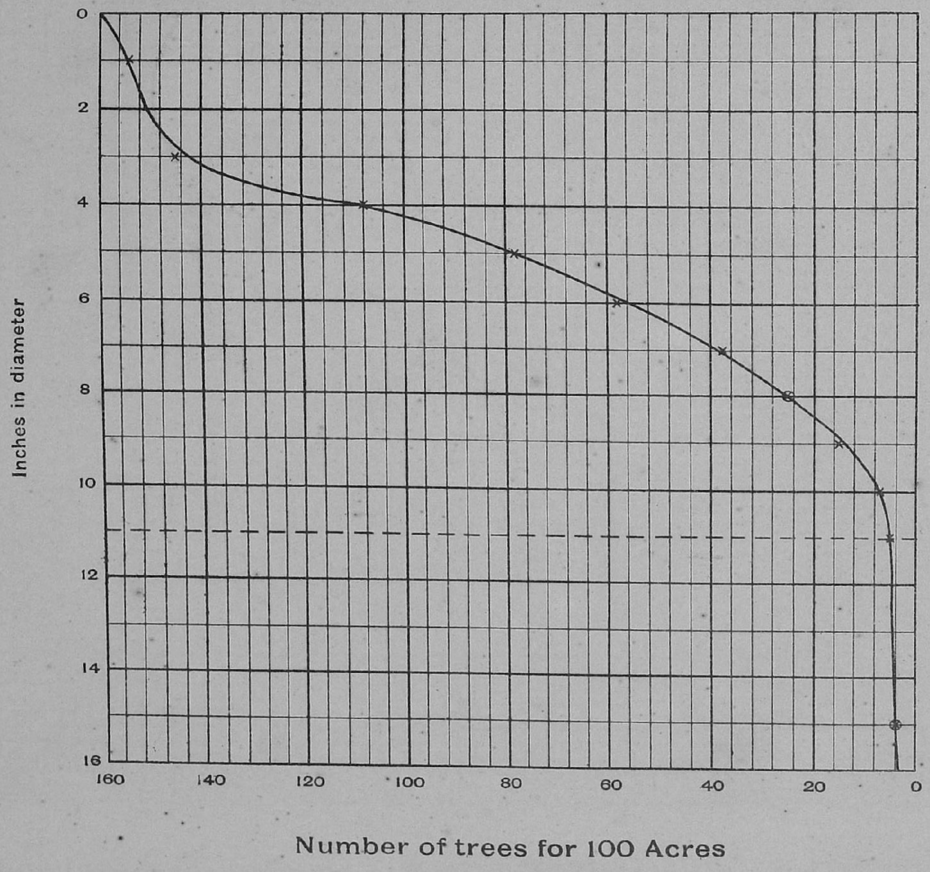
Height of section	Number of rings.	Number of years which the tree took to reach that height,
...	100	...
2	98	2
6	89	11
10	86	14
14	82	18
18	77	23
22	69	31
26	56	44

APPENDIX X.

GRAPHS.

GRAPH No. 1. (APPENDIX No. X)

Graph to shew decrease in number of trees to the acre as diameter increases.



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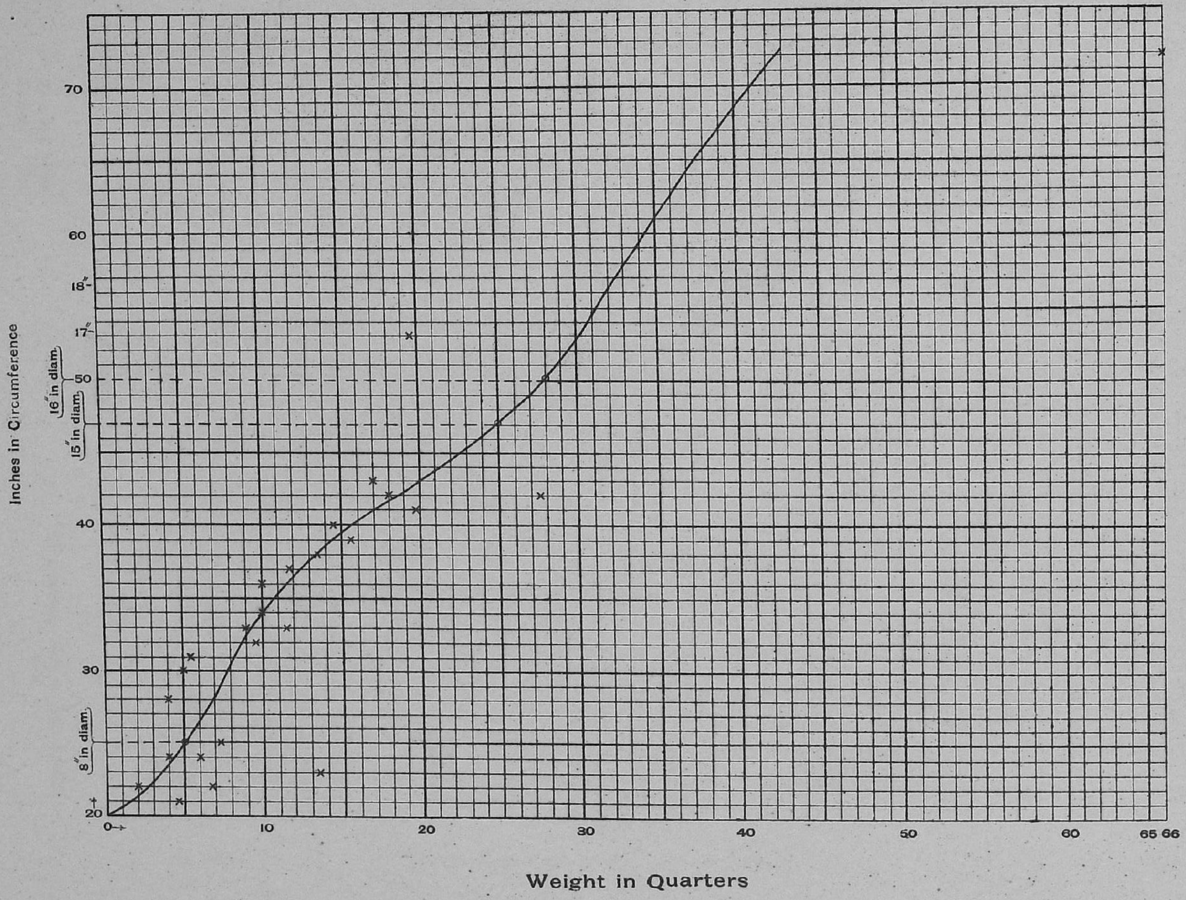
GRAPH No. 2. (APPENDIX No. X.)

Increase in weight of heartwood for diameter classes.

(Compiled from figures furnished during the sandal operations in South Vellore in 1913-14.)



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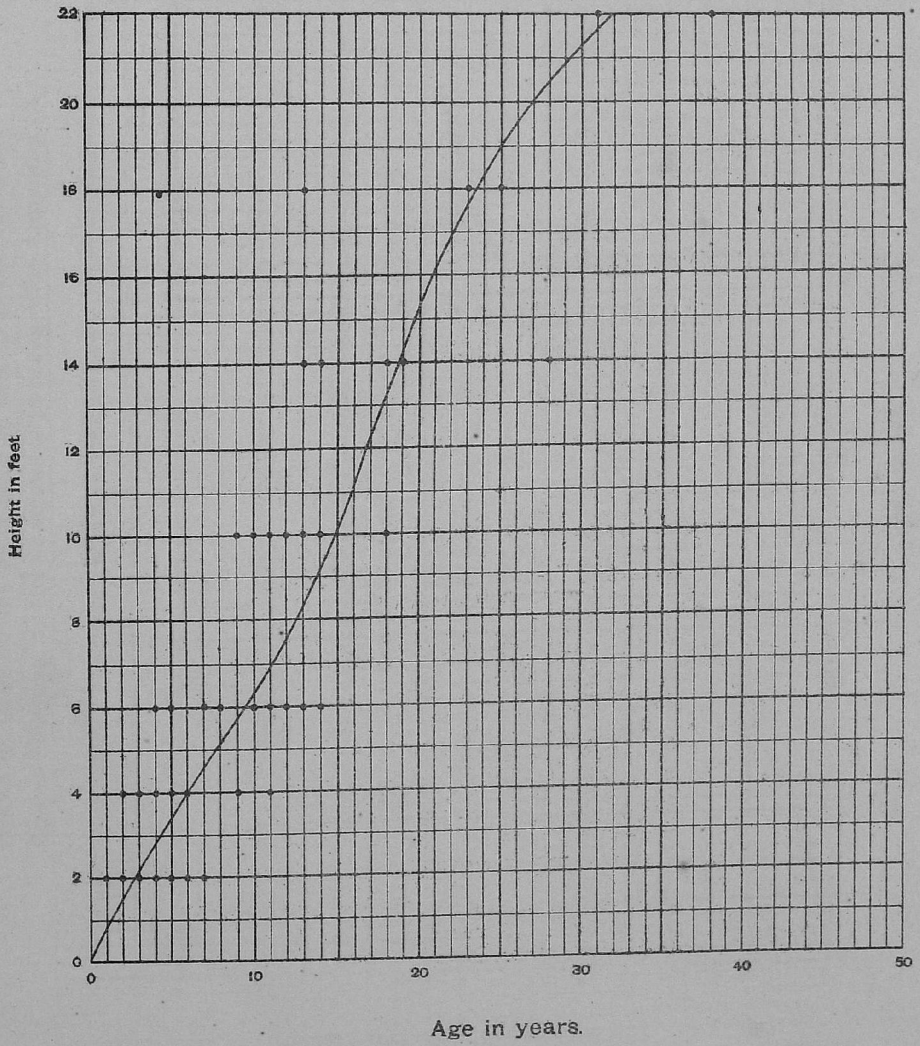
GRAPH No. 3. (APPENDIX No. X)

Graph to shew height growth of bole of sandal prepared from figures obtained by the analyses of 17 trees. Vide Appendix IX.



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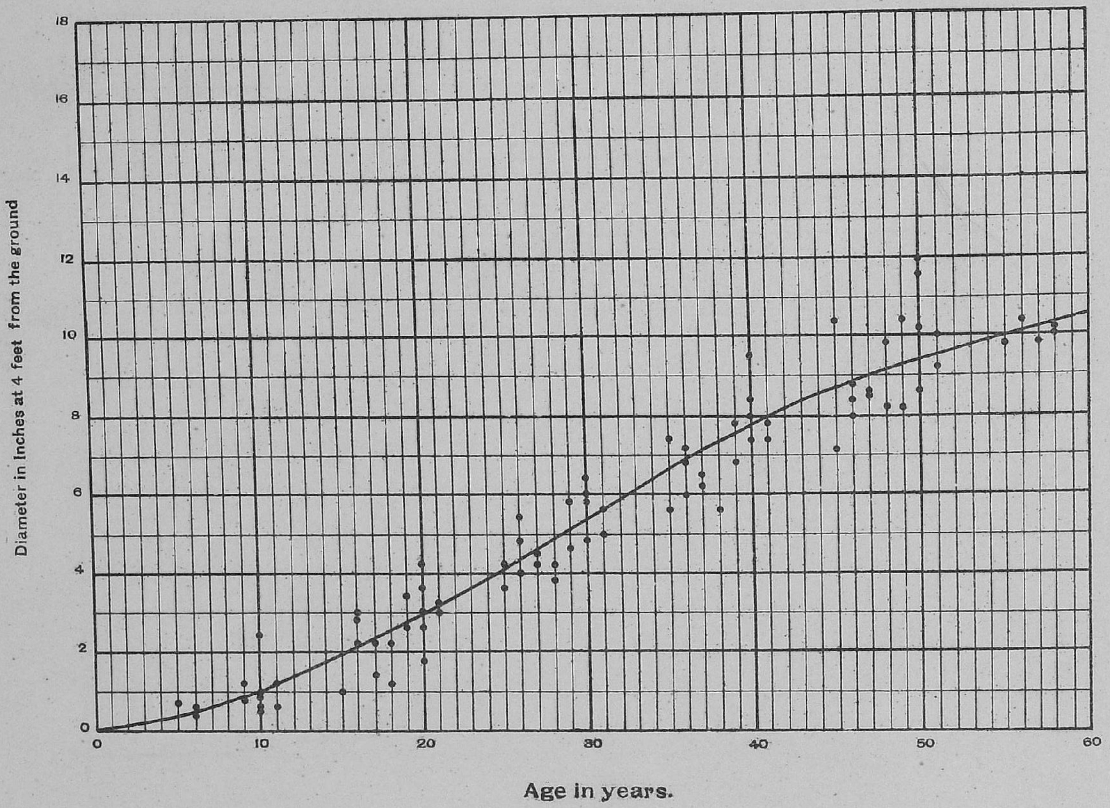
GRAPH No. 4. (APPENDIX No. X)

Graph to shew diameter growth of sandal prepared from figures obtained by the analyses of 18 trees. Vide Appendix IX



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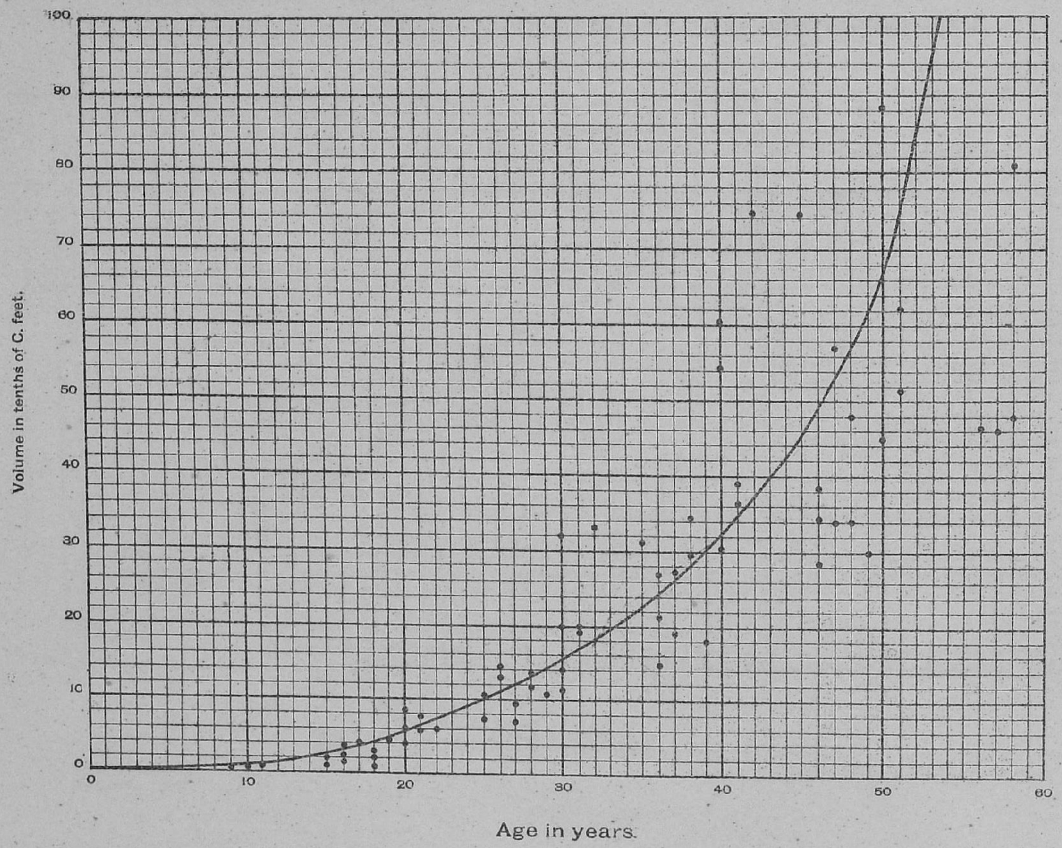
GRAPH No. 5. (APPENDIX No. X.)

Graph to shew volume growth of sandal prepared from figures obtained by the analyses of 16 trees. Vide Appendix IX.



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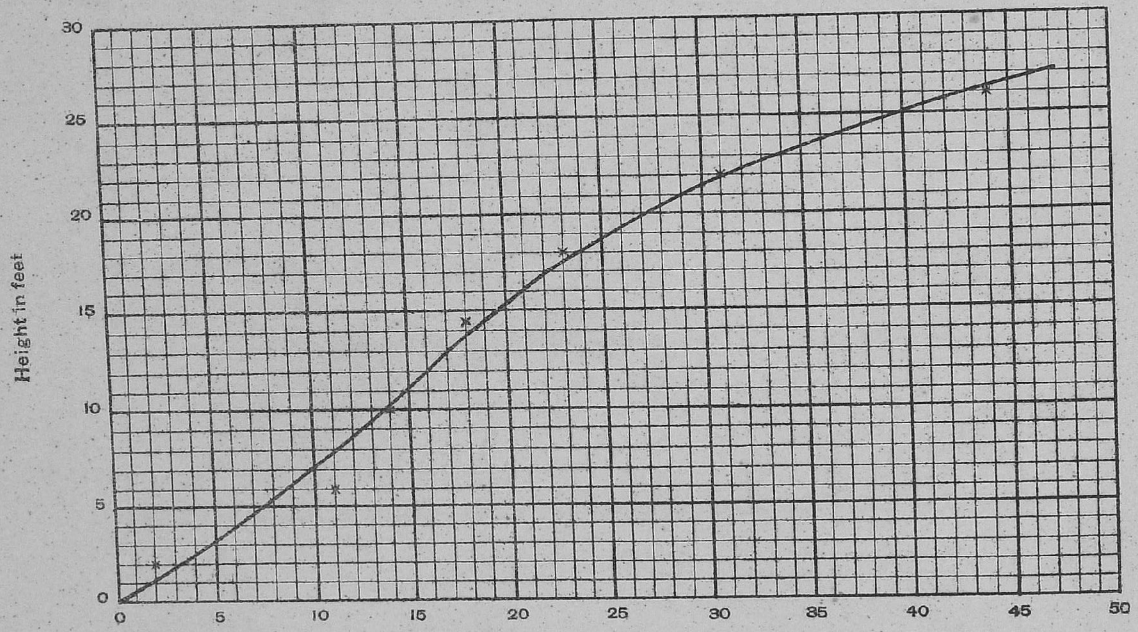
GRAPH No. 6. (APPENDIX No. X)

Graph to shew height growth of bole of a sandal tree 100 years old, felled and analysed in the Javadis near Kilthattiapattu.



Age in years.

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GRAPH No. 7 (APPENDIX No. X.)

Graph to shew diameter growth of a sandal tree, 100 years old, felled and analysed in the Javadis near Kilthattiapattu.

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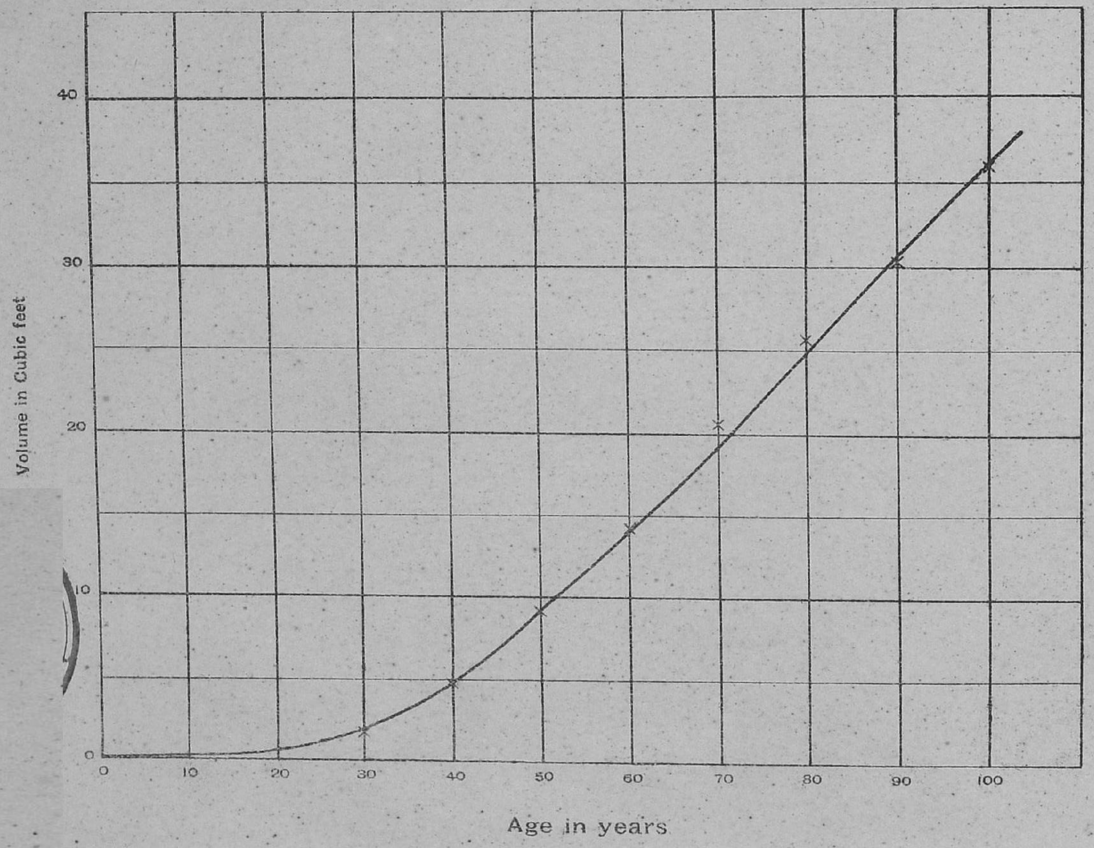
GRAPH No. 8. (APPENDIX No. X)

Graph to shew volume growth of a sandal tree, 100 years old felled and analysed in the Javadis near Kilthattiapattu.



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Helio-Zinco., Survey Office, Madras.
1916

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No.—D. Dis. 21.

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Letter—from the Conservator of Forests, Southern Circle.
To—the Secretary to the Commissioner of Land Revenue (Forest).
Dated—the 14th June 1915.
No.—564/15.

Resolution—Forest No. 172, dated 13th December 1915.

The Board sanctions the Working-Plan for the sandalwood forests of the Javadi and Yelagiri hills in the South Vellore division, subject to the following remarks :—

Paragraph 6.—The Board is not prepared to sanction further reservation except of the portion of the Puliyur unreserve lying to the west of Chittoor village which lies on the outer slopes of the Javadis and in which the sandal has been extensively hacked for browsing. It was only here and at Belur village that the Forest Commissioner, in the course of his recent tour, observed very serious damage to sandal. Damage in Kambugudi was slight and in the tract between Komuttiyur and Patrakad there was none at all. The Commissioner was given to understand that protection on the Chengam Javadis is satisfactory. Thus the co-operation of the Malayalis in the protection of sandal appears to have already been secured over a considerable portion of the Javadis without any special effort, and there is reason to think that the grant of appreciable concessions to these people will have the effect of inducing those villages, where damage has been greatest in the past, to protect the tree in their own interest. It seems certain that further reservation on an extensive scale would bring the Malayalis into strong antagonism with the Forest Department and that protection would seriously suffer in consequence.

Paragraph 8.—The proposal to purchase sandal trees belonging to pattadars in order to minimise opportunities for theft is approved, as also the Conservator's proposal that payment may be made at a fixed rate according to girth.

Paragraph 34.—As suggested by the Conservator, girdling should be limited to the Melpat Felling Series of Tenmalai reserve, and a yearly note should be made of the results.

Paragraph 38.—The Board agrees with the Conservator that "Ponnakad" cultivation should not be encouraged. The regeneration of sandal from seed is so good on the Javadis that it is unnecessary to attempt to further its spread by the drastic method of cutting down the forest.

Paragraph 39.—The Board has arrived at the following conclusions on the subject of concessions to the Malayalis :—Grazing concessions for Malayali cattle should be granted in return for the protection of sandal, the inhabitants of each village being held responsible for the forest within the recognised village limits. Grazing fees should be collected at the beginning of the year (preferably in a lump sum for each village based on a cattle census) and returned at the close either in whole, in part or not at all according as the protection during the year has been good, indifferent or bad. For protecting the forests from fire the Malayalis should be paid separate money rewards. There should be no difficulty in inducing the Malayalis to give up their goats. In regard to plains cattle it should be possible to materially reduce their numbers, if not prevent their immigration altogether, by the imposition of a heavy grazing fee.

Paragraph 41.—The Board agrees that the staff must be materially increased to ensure proper working of the plan. As the plan is to be introduced at once, the Conservator is requested to make proposals for the necessary staff which will be placed for the present on the temporary scale.

The Board thanks Mr. Wilson for the excellence and thoroughness of his Working-Plan. Mr. Wilson has undergone much exposure in an unhealthy climate and considerable extra expense in its preparation and his claim to a Working-Plan allowance will be submitted to Government with the Board's cordial support.

(True Extract.)

G. T. H. BRACKEN,
Ag. Secretary.

(True Copy.)

K. GUNDU RAO,
Forest Assistant.

To the Conservator of Forests, Southern Circle with maps returned.
,, the Collector of North Arcot.
,, C. C. Wilson, Esq., Special Working-Plans Officer, Southern Circle, through the Conservator of Forests, Southern Circle.
Copy to other Conservators (two spare copies to each District Forest Officer.)
,, the Agent to the Governor in Ganjām.
,, the Principal, Madras Forest College, Coimbatore.
,, the Secretary to Government, Revenue Department.